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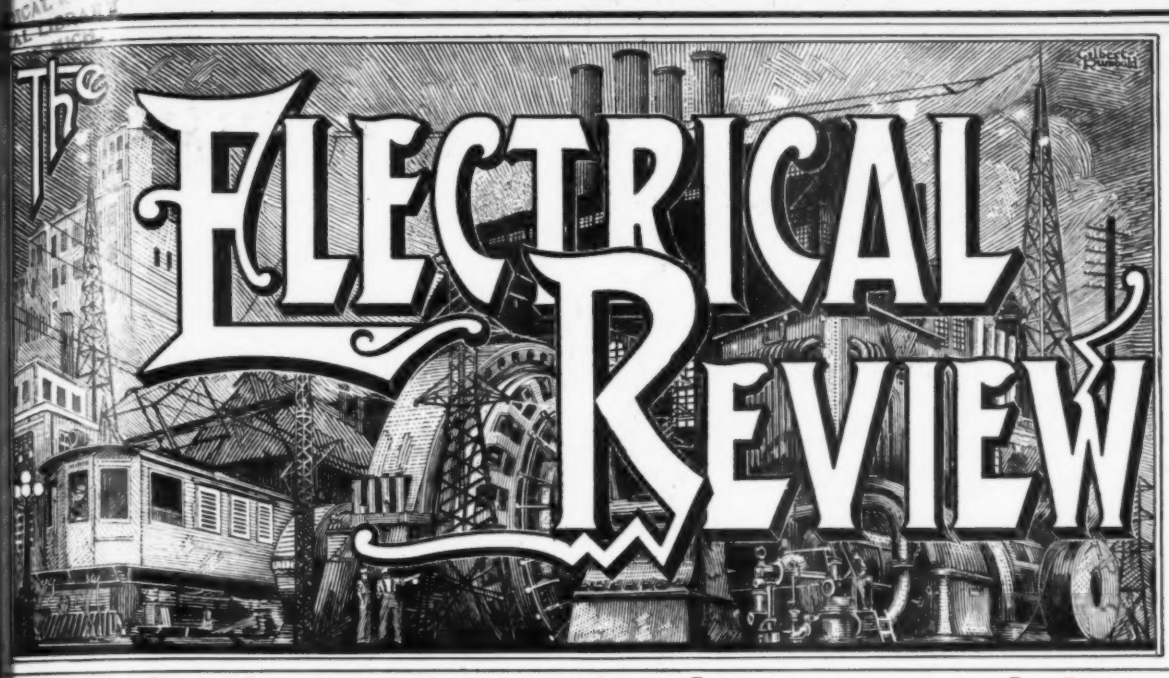


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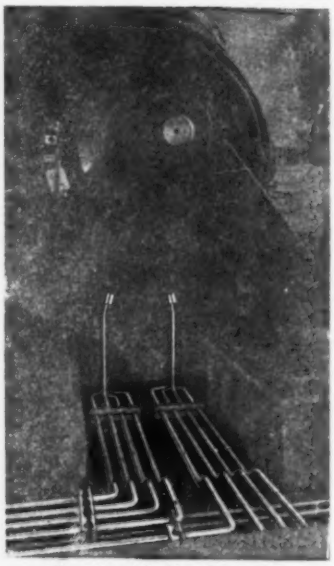

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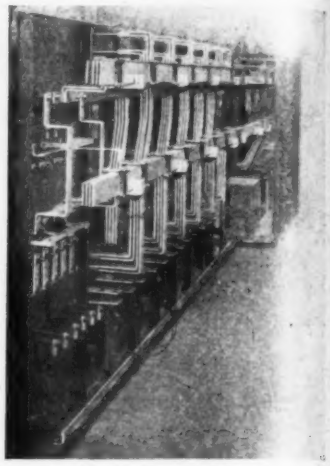

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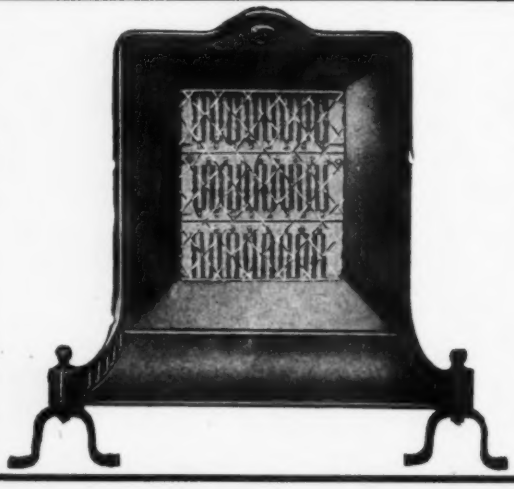

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## ELECTRICAL REVIEW.

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## MUNICIPAL TRAMWAY MATTERS.

SEVERAL highly important matters were discussed at the Conference of the Municipal Tramways Association, a report of which is concluded in this issue. In a way they are subjects of perennial interest, inasmuch as it is not the first time they have been brought before conferences of the Association; but the position with regard to them is changing somewhat, owing to the existence of the Ministry of Transport and the possibilities thereby introduced of getting things done which otherwise were well-nigh impossible. Road maintenance and motor 'bus competition were two matters which received great attention, whilst on the more technical side—although technical problems did not receive much consideration — the advantages accruing from the lightening of cars and their equipment and the adoption of trolley 'buses came under review. The former are now well-worn themes, and no new case can be made out with regard to them. Briefly, the tramway authorities complain as bitterly as ever that motor 'buses use without payment the roads that are built and maintained by the tramway undertakers, and are thereby helped the more successfully to compete with tramways. The Tramways Association and the Association of Municipal Corporations have appointed a joint committee to consider the whole position, and the Executive Council was urged, at the Conference, to make representations to the Ministry of Transport at the earliest possible moment. The problem is beset with many difficulties, and, concerning road maintenance as distinct from the general question of competition, the tramway authorities must walk warily, having regard to certain views expressed by members of the Association with respect to the use of trolley 'buses. Whilst it is the general desire to make motor 'buses pay some contribution towards road maintenance—or conversely to relieve the tramways of the necessity for making such large payments for that purpose—the advocates of the use of trolley 'buses are contending that these vehicles should not pay for road maintenance, and that the tax of £70 a year that is paid upon the vehicles largely comes back to the local authorities from the Road Fund for the repair of the roads. That is also an argument which the motor 'bus companies may well use in any attempt to place road maintenance partially upon them.

Opinion seems to tend to the view that tramways should be relieved of their heavy road-maintenance obligations, so perhaps the apparent anomaly just referred to will not arise. Then, however, we should probably find Highway Committees objecting to having to find more money for road maintenance, in order to enable the tramways to make a better showing. There is evidence of that already.

Motor 'bus competition is another matter entirely. The suggestion has been put forward that some body, similar to the Electricity Commission, should be appointed, to parcel out the country in such a way that there would not be foolish and wasteful competition, and to see that the most efficient use was made of the existing facilities. Some local authorities raise objections to that proposition, partly because they seem to be chaffing under a sense of grievance in that the expenses of the Electricity Commissioners are chargeable upon them—and they assert that they do not want the same

sort of thing in respect of transport—and partly because the parochial idea is still deeply ingrained, although this type of local authority is always anxious to go into the districts surrounding its own whilst strongly resenting any comprehensive scheme which might make its particular locality part of a larger and more efficient system. However, the competition question is no less difficult than the road maintenance one, because of the legitimate fear of granting monopolies, and possible inconvenience to the travelling public. It is admitted that many tramway systems cannot carry all the traffic on certain rush occasions, even with a 100 per cent. overloading of the cars. At present this is relieved by the so-called "pirate" vehicle—for instance, the charabanc in connection with the big football matches. Are these services to be suppressed? It is admittedly not an easy problem, albeit no one can deny the justice of the complaint against irresponsible and intermittent rival services which compete only at times profitable and convenient to themselves.

A great controversy is going on in tramway circles as to the use of trolley 'buses. Some managers and members of committee are already inclined to the view that they should displace tramways where heavy expenditure on track reconstruction would otherwise be necessary, and that, now that their seating capacity is being increased almost to that of tramcars, they will be able to deal with the traffic with equal facility and more cheaply than tramways. Others hold the view that only on certain routes where the traffic is light will the trolley 'bus hold its own against the tramway. Now that we are up against a period of large expenditure upon track reconstruction, it is obvious that the trolley 'bus will receive close attention, especially in view of the success of this system at Birmingham upon a route which many tramway managers would not call lean, and of its success in other places, such as Bradford, Leeds, Tees-side, &c. Each case will have to be considered in relation to its own particular circumstances, but this much can be said with absolute certainty—the trolley 'bus is in a far stronger position than it was a few years ago, and where there is a cheap supply of energy available, it can hold its own with the petrol motor 'bus.

Finally, we come to the question of lightening cars and car equipments, dealt with by Mr. Pilcher, whose paper was really an advocacy of scrapping existing heavy equipments and reversing the tendency of past years to increase rather than decrease the weights of tramcars as a whole. This question will be viewed by tramway authorities in the same manner as scrapping propositions always are viewed by everybody, *viz.*, with great caution, if not with suspicion. Mr. Pilcher had the advantage in Edinburgh of starting more or less *de novo*, inasmuch as he recently converted a cable tramway system to electric traction, and therefore did not have to scrap electrical equipments, heavy, it will be admitted, and perhaps a little costly to operate, but still in a sound mechanical and electrical condition. Courage is required in such circumstances to incur a heavy capital expenditure upon more up-to-date equipments, even if a saving can be shown in estimates or has been proved in fact. The same problem is facing many electricity supply authorities, and the same degree of caution is being exhibited. One important fact demonstrated at the Conference was that the members were drifting away from the term "tramway authority," and developing more into "transport authorities," which is as it should be. The tramway managers of the larger cities are no longer bound hand and foot to electric tramways, but are adopting, according to the conditions in different parts of their areas, tramways, motor 'buses, and trolley 'buses. That seems to be the beginning of a more enlightened era when we shall get away from the petty idea that one system is the best and only one, and that none of the others ought to be allowed to exist. It may also be the beginning of a development in the direction of co-ordination of transport facilities, which is urgently needed, having regard to the growing congestion of our highways.

**Work Wanted.**

Can it be said that the problem of unemployment is being dealt with in a manner that is just, rational, and proper? It may be premised that sentiment touching the tragedy is common ground, and may be excluded from the argument. All must have agreed with Mr. Clynes when he declared that men who saw the facts were appalled at the prospect of a large part of the population settling down as permanently unemployed. He was speaking as president at a meeting of the National Federation of General Workers, which during the last two years has decreased in membership from 1,293,793 to 543,303, and it was natural that under such circumstances his expressions of opinion should be somewhat chastened. His words precisely summarise the situation, however, and make a demand upon men of all professions, trades, and denominations to concentrate anew upon the task.

So far as our own industry is concerned, it has been suggested in certain quarters that orders for electrical machinery have been withheld in the belief that prices may fall still lower. We believe this view to be a mistaken one; we know that in many cases British prices for heavy plant have been cut to a point which allows no profit, owing to the severity of foreign competition.

In the field of electricity supply, both companies and municipalities have, generally speaking, done well from the financial standpoint. Are they satisfied that they have ordered everything that may be needed to meet the requirements of the immediate future?

In the majority of cases it is probable that the orders have already been placed, but if there still remain any who are holding back in the hope of further price reductions, we would plead with them to take the longer view and let the manufacturers have the benefit of their orders before the winter is hard upon us.

---

**Educate the Public.**

In a recent address to the Public Relations Section of the National Electric Light Association, Mr. E. V. Ruykendall, Commissioner of the Washington Department of Public Works, dealt with the attitude of the American public to the large "utilities" supplying them with electricity, gas, water and transport. He described this as a David-and-Goliath disposition, the "utility" being the detested giant and the consumer the hero with the sling. In a country like the United States, where public services are in the hands of corporations, and the very word "corporation" is anathema to the man in the street, this attitude is understandable if not justifiable. While this feeling of antagonism is not so rife in our own country, who shall say that it does not exist? Even here an injury done to a supply company or a municipal electricity department is often deemed to be on a par with the evasion of income tax—a venial crime.

High prices are not the only constituent of this atmosphere of suspicion; it will be found that lack of knowledge is to blame for a great deal. Mr. Ruykendall urged his audience to put everything possible before the consumer to show him the injustice of antagonism towards those who serve him well. "The remedy lies in an open, candid presentation of the facts to the public mind, the substitution of truth for error, and the eradication of prejudices born of ignorance and misinformation." He said that the fact that large masses of the people could be prejudiced against public utility corporations by local or national politicians indicated that the average citizen knew nothing of utilities and their regulation. One means of education suggested was to start at the beginning, in the schools, but then the teachers must first be instructed.

However, in this country education is proceeding slowly and the influence of the British Electrical Development Association, together with the efforts of the subscribing bodies and their staffs, is gradually making

itself felt. By these means, with lower prices as an additional factor, we shall soon have a public electrically enlightened, a state of affairs which will result in increased benefits to the industry.

---

**British Work for British Workmen.**

Whilst New Zealand, at the other end of the world, is placing large orders — running to millions of pounds—in this country at prices above those quoted by foreign manufacturers, certain buyers at our own doors are sending orders to the Continent; looking out of their office windows these buyers may see British workmen standing idle for want of a job. If they look further—into their own accounts—they will there see that they are paying large sums in taxation to contribute to the support of those unemployed workmen, who number well over a million. In no other country in the world is unemployment so rife as it is here—yet, with crass stupidity, these buyers continue to give work to foreign hands at the cost of their own fellow citizens. To call this policy short-sighted would be a misuse of the term; it is utterly blind—and not only blind, but deaf to the arguments of common sense, of humanity, of patriotism. In some cases, moreover, it is dumb; large orders for machinery which could have been better made in this country have been placed abroad by companies, whose operations are not open to the public eye, and whose managers are mute. Blind, deaf, and dumb indeed!

Municipal authorities must necessarily conduct their business in public; they handle public moneys, and they are in duty bound to have regard to the needs of workers of their own nationality. A splendid example has been set by the London County Council and by the great majority of the local authorities throughout the country, the latest instances being the Corporations of Leeds and Bradford, both of which have rejected the temptation to order electrical plant abroad. Apart from the unemployment question, these buyers are spending wisely, for they will get better plant, the efficiency of which will be up to guarantee, and which will prove more reliable than imported machinery. As for those others that prefer to pay British workers for standing idle with the money that they "save" by buying foreign goods—well, we hope they will get the kind of plant that they deserve. Probably they will.

---

**The Value of Research.**

Recently the head of the research department of the British Dyestuffs Corporation, Dr. Green, resigned his position on the ground that the board of directors included no one with expert knowledge of the industry. This is the second or third occasion on which this has occurred in connection with the same corporation, and if repetition carries any weight, it would appear that there must be good reason for complaint on the part of its scientific advisers. We are sorry to see that in *The Times Trade and Engineering Supplement* the view is expressed that the policy of the board is the right one: the board "should concern itself chiefly with the efficient commercial production of those dyes of which the constituents are known rather than with making fresh discoveries"—and this, forsooth, because the times are bad and output is restricted!

This comment is typical of the national attitude towards science. The company is recommended to busy itself only with those products in which competition is keenest, in order that the dividend may be paid on the shareholders' capital—the path of "safety" which leads to ruin! When will the British public learn the lesson with which their foreign competitors are so well acquainted—that money spent on research is by far the most profitable expenditure that they can incur? By the time they have reduced the cost of manufacture of the common products to the lowest possible figure, their competitors will be marketing new and better substances, or the same ones produced by far cheaper processes. Whether the presence of a technical expert on a board would suffice to enlighten the other directors on this subject is somewhat doubtful, but there is no doubt at all about the enormous value of research, particularly when trade in customary products is at a low ebb.

Fortunately, in the electrical industries the importance of research is better appreciated. The splendid work done recently on underground cables by organised research, to say nothing of the many other investigations in progress in the electrical field, or of the large research department opened this year by the General Electric Co., indicates that electrical men are following the path which leads to the front rank of progress, and are not content, as our contemporary would have the dye makers do, to follow in the ruck.

---

**Cast Iron to Resist Corrosion.**

The results of the joint research about to be undertaken by the Cast-Iron Research Association and the Electrical Research Association as to the action of sea water on cast iron should be of very great value. It may result in an alloy that will effectually resist the corroding and eroding influences of sea water, and which will also be acid resisting. The rusting of iron has usually been regarded as an electrochemical phenomenon. The corrosion of either iron or steel is accelerated by contact with an element like copper or tin, electropositive with respect to iron. It may, on the other hand, be retarded with a comparatively electronegative metal like zinc. A single metal, again, differs in its electrical properties in its annealed and cold-worked conditions, and the contact of the two may induce corrosion. It has been shown repeatedly that a metal which is locally cold worked is very susceptible to corrosion. Cast iron, of course, is not cold worked, but the melting conditions may have as great an influence on its molecular constitution.

A Committee of the Institution of Civil Engineers is now investigating the deterioration of structures of timber, metal, and concrete under the action of sea water, and the final results will, it is hoped, lead to substantial economies in the cost of maintenance of docks, piers, and other marine structures. There could be no better combination for investigating the causes of cast-iron deterioration than that of the metallurgist and electrical researcher, and the two years which will be given to the work should be ample, if not to obtain a final solution, at least to make very important discoveries.

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**The Zurich Bank for Electrical Undertakings.**

As a result of differences in exchange quotations, the Bank für Elektrische Unternehmungen, of Zurich, was compelled to write down its ordinary shares from 75,000,000 fr. to 18,750,000 fr. in 1921, and to convert the loan capital into preference shares. At the end of the financial year 1921-22 the account of "uncovered difference in exchange quotations" still remained at the large figure of 51,210,000 fr. In the meantime a fresh scheme of organisation has been in course of preparation, and has now been announced. Under this plan the directors recommend that the nominal value of the ordinary shares should be reduced from 250 fr. to 50 fr. each, and that of the preference shares from 1,000 fr. to 500 fr. These operations would yield a book surplus of 62,000,000 fr., which sum would be more than sufficient to meet the previously-mentioned differences in exchange quotations. If this scheme should be carried out, any net profits would be available henceforward for distribution among the preference and ordinary shareholders according to a pre-arranged basis, and as a sum of about 3,000,000 fr. is estimated to represent the net profits for 1922-23, the preference shares, at all events, would receive a 6 per cent. dividend for that year under the new scheme of organisation.

# THE WELDING CURRENT OF OIL SWITCHES.

By G. L. E. METZ.

MANY interesting articles have been written and papers read on the subject of oil switches during the past few years, and yet, even to-day, comparatively few of the important problems affecting their design can be solved from first principles. A combination of past experience and data of an empirical nature has to be accepted as a substitute which is far from satisfactory. Probably the most important and at the same time most involved problem to be investigated at the present time is that of rupturing capacity. As far as the author is aware there is no standard formula in existence which can be applied generally to an oil switch to obtain its rupturing capacity with any degree of accuracy.

In the past it has been usual to express this value in kVA, but the general tendency seems to break away and follow the Continental practice and rate the switch according to the maximum current it will break and carry for a given time. And there is little doubt that this method has much to commend it.

The question then arises what factors limit the current-carrying capacity of a switch for a given time without deterioration, or damage. Omitting the phenomena caused by the opening discharge, these effects may be classed under two headings:—(1) Mechanical, (2) Heating effects. Of these two it is the heating effects that usually are responsible for the main trouble. This fact has been accentuated of recent years, when every effort is being made to get a breaker of small and compact size to interrupt as large a current as possible.

It should be remembered that a safe limit is fixed beyond which it is very inadvisable to go, for an oil switch can only dissipate a given amount of energy in a certain space; directly the dissipation factor is passed an explosion takes place or some mishap which automatically increases the size of the breaker, but at the same time ruins it.

The heating effects which do so much to limit the amount of energy an oil switch will dissipate, are discussed in this article, and by means of a simple formula the welding current has been obtained. It has been assumed that the oil switch under consideration is capable of carrying normal full-load current without undue heating, and all remarks hereafter will refer to short-circuit conditions.

Modern practice demands that an oil-immersed circuit-breaker should interrupt the circuit as soon as ever possible after the occurrence of a fault. While many devices are in vogue for hastening the speed of break, such as accelerating, or kick-off springs, there still remains a short but appreciable time between the instant of short circuit and the final rupture of the discharge arc. The problem is to ascertain just what current the oil switch will carry for this short duration of time without the welding-up of the contacts.

The arcing contacts carry the short-circuit current directly the main brushes part company, and it is on these contacts that welding usually occurs.

The temperature rise that takes place at the arcing contacts is proportional to $I^2RT$, where I is the short-circuit current in amperes, R the contact resistance in ohms, and T the time in seconds.

The short-circuit current of a system may be considered as constant, and the duration of the current in seconds is also constant, so R, the contact resistance, becomes the variable.

The importance of the millivolt drop across the arcing contacts is then evident. Very often ample care is given to bedding the main contacts while the arcing tips are almost ignored, with a consequent increase of heating and decided reduction in the welding current of the switch.

Before any actual calculations are gone into, a rapid investigation of the short-circuit current and its magnitude will be made.

As is well known, the current of an alternator, when on short circuit, reaches a very high value at the instant of the fault occurring, and then rapidly dies down exponentially to a permanent value, all of which occupies a very small space of time. In many calculations it is permissible to ignore this fact and deal with the permanent value of short-circuit current only; but, as the oil switch also operates in a very small interval of time, it must be considered in calculations made to obtain the welding current. The reason for this great difference of current value is not difficult to understand.

At the first instant the current is limited by the armature resistance and reactance. This reactance is caused by the armature current itself, and is therefore simultaneous with the short circuit.

Another factor will come in with the increase of armature current, namely, demagnetising effect or armature reaction; as the armature ampere turns increase so they react on the field circuit.

The field circuit represents stored magnetic energy; being inductive, however, it will be slow to respond to any change of conditions, having the characteristics of inertia. Therefore, the armature interference will not be simultaneous with the short-circuit current, but will gradually build up following a transient which will be determined by the field constants. From this it can be seen that the short-circuit current will decrease from a high initial value proportionately to the effective field

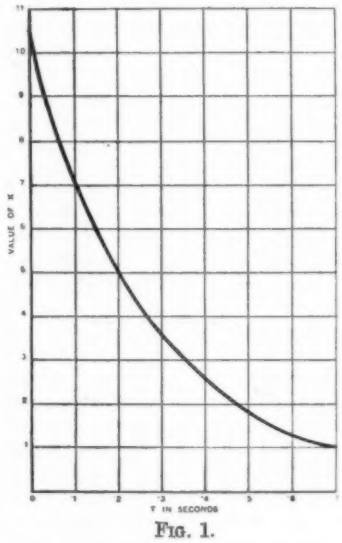


FIG. 1.

flux to a much lower constant value. The magnitude of the initial current will be limited by the armature reactance only, neglecting external factors, while the permanent value of the short-circuit current will be fixed by the armature reactance, plus armature reaction, which is known as the synchronous reactance. At this point reference will be made to the doubling effect that occurs, depending upon the position of the voltage wave at which the short circuit takes place. A thorough investigation of this most interesting phenomenon would be out of place in this article. Suffice it to state, therefore, that in the event of a short circuit occurring at the instant the voltage passes through its zero position, the resulting current will be unsymmetrical, and may reach almost double the value it would have had in the case of a symmetrical short circuit, hence the term "doubling effect." From the foregoing it can be seen that the value of current that causes the heating effects will be an average of the currents flowing while the switch is opening, and will be somewhere between the instantaneous value and permanent value of the short-circuit current.

A curve is given connecting the value K, known as

the damping constant, with time, and this constant takes care of the phenomenon alluded to. The actual curve, fig. 1, is for a particular machine, and will, of course, vary with varying designs and type of generators.

Considering the actual oil switch shown in fig. 2, the welding current will now be obtained in a simple manner.

The temperature rise for a given current, neglecting radiation, is given by $I=\sqrt{(4.2\ S\ M\ \phi/R)}$, where 4.2 calories per second = 1 watt; S = specific heat of copper = .43 calories per lb.; M = mass of affected copper in lb.; $\phi$ = temperature rise in °C.; R = ohmic resistance of arcing contacts.

If the switch operates at 30° C. when on normal full-load current and the melting point of copper is 1,040° C., then the temperature rise $\phi$ between normal and welding point will be 1,050 − 30° C. = 1,020° C.

The millivolt drop across the arcing contacts has

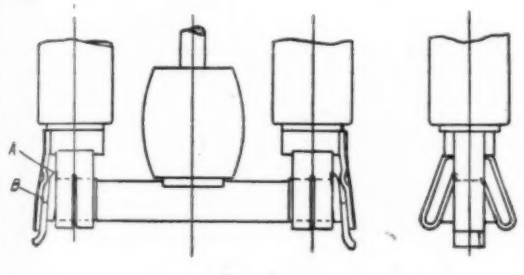


Fig. 2.

been assumed as 40 mV at normal full-load current of 300 amperes. At first sight this may appear excessive, but it must be remembered that oil switches are very roughly used in practice, and ample allowance should be made for indifferent contact. Then the contact resistance in ohms $R=40/300\times10^3=.000133$ ohm. The only remaining factor to fix now before the welding current is obtained is the mass of affected copper. The result of observations that have been made tends to confirm that the heat produced by the passage of the short-circuit current does not penetrate deeply into the arcing contacts. Actual solid welds rarely occur; in most cases small pin-heads of metal are formed, and these, together with a certain stickness of the contacts due to the high temperature, prevent the rapid opening of the switch, and it is this extra hanging time that may result in a solid weld. In calculations, however, it is the small pin-head welds that are dealt with, these being more common, and there is little doubt that arcing contacts require a large surface area more than a great depth of metal. A depth of penetration of 1/16 in. has been taken in these calculations, and it should be added that they lined up very well with the figures obtained from actual tests.

Substituting the values to hand in question, $I=\sqrt{(4.2\times43\times0.112\times1,020/0.000133}=3,950$, say 4,000 amperes.

This is the value of current necessary to raise the mass of copper under consideration to a temperature of 1,050° C. in unit time, *i.e.*, one second.

This particular switch, however, cleared a fault in 0.3 second; the current necessary to produce this temperature under similar circumstances, but in this duration of time will then be given by $4,000/\sqrt{0.3}=7,300$ amperes.

The value of the permanent short-circuit current to the equivalent heating of 7,300 amperes in 0.3 second is obtained by dividing the current by this damping constant, namely, $7,300/K$, the value for K, obtained from fig. 1, being taken as 3.75.

Hence the permanent value of short-circuit current liable to cause welding of the arcing contacts before the fault is cleared is $7,300/3.75=1,950$ amperes.

It is not suggested that the calculations above are absolutely accurate; so many factors have to be covered that this can hardly be expected.

The fact that they have compared very well with figures obtained from actual tests seems to show that the method of approach is correct, and renders the equation valuable as a check on this all-important question and also for comparison between similar types of arcing contacts mounted on different switches.

Recent tests made at a large generating station at Newcastle have shown that the type of arcing contacts in fig. 2 have not so much to recommend them as those of the plunger type. In one particular instance the switch operated on a heavy short circuit, and in doing so a slight globule of metal was formed on the arcing tip at the point A, on the switch being reclosed, the globule forced the arcing contact out momentarily, and passed it. The next time the switch was operated, this globule of metal caught on the arcing contact at B, and held the switch, a complete weld resulting.

## ELECTRICALLY PROPELLED BARGES.

### Interesting Experiments at Kidderminster.

Whilst the subject of improving inland water transport has received increasing attention within recent years, the efforts of those interested in the resuscitation of British canals have hitherto been mainly directed towards the betterment of the waterways themselves and comparatively little has been attempted by way of developing new methods of hauling or propelling barges and other craft thereon. The experimental work which the Shropshire, Worcestershire and Staffordshire Electric Power Co. has done during the past two years with a view to modernising the Midland waterways to suit present-day requirements is therefore of some interest. The company, which transports well over 100,000 tons of coal per annum over Midland waterways, is associated with the Birmingham and Midland Tramways Joint Committee, and operates both the Halesowen Lighting & Traction Co., Ltd., and the Kidderminster and District Electric Lighting & Traction Co., Ltd.; in deciding to test practically a system of electrically-driven water-jet propulsion it has adopted a combination of well-known principles which is peculiarly suitable to navigation in weed-grown shallow waterways wherein the liability of encountering floating and submerged obstructions is ever present.

The company provided the electrical gear for equipping one of its large fleet of canal barges, the Gill Propeller Co., Ltd., of King's Lynn, designing and supplying the hydraulic jet pump, and with the permission of the Staffordshire & Worcestershire Canal Co. a by no means straight portion of the canal at Kidderminster, including two low bridges and one lock, was equipped with the necessary overhead conductors supported on poles. Owing to the width of the waterway the method of collecting electricity is to use a small two-wheeled carriage running on the two overhead wires, it being drawn along behind the barge by a trailing cable (figs. 3 and 5).

The power unit is supported by, and housed in, a steel tube of 2 ft. 6 in. diameter that is open to the water at the bottom of the barge; the total weight of the power unit is approximately 24 cwt. The whole propelling unit is enclosed in a cylindrical casing, which

can be lifted bodily into or out of the fixed cylinder, figs. 1 and 2, within which it can be freely turned by hand, friction being reduced by roller bearings. Inside the casing a 250-volt, 18-h.p., 720-r.p.m. Electromotors vertical-spindle motor is coupled direct to a 10-in. Gill centrifugal pump, *a*, fig. 2, constructed by Messrs. Drysdale & Co., Ltd. The section shows that the pump inlet *b* projects slightly below the bottom of the barge and is fitted with a number of guide blades which

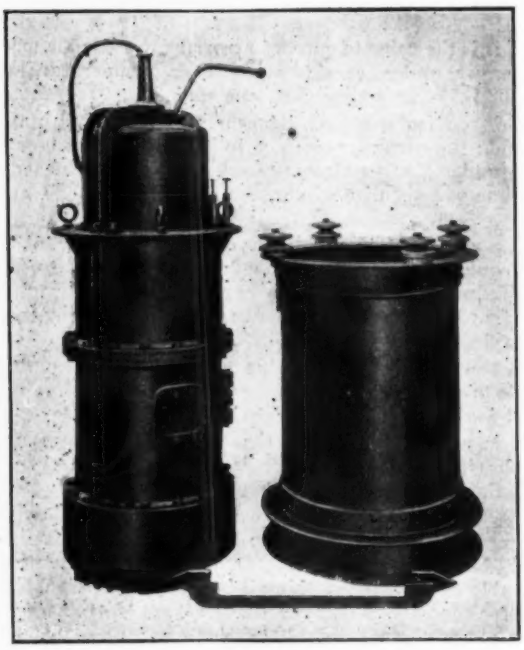

FIG. 1.—EXTERIOR OF APPARATUS.

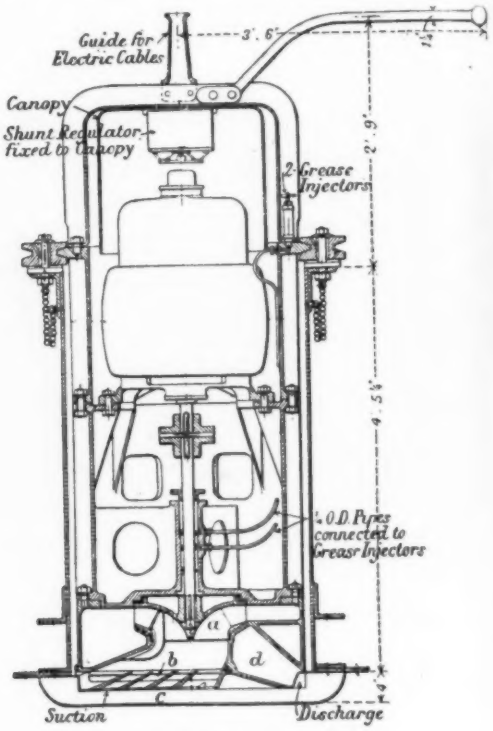


FIG. 2.—VERTICAL SECTION.

ELECTRICALLY-DRIVEN JET PROPELLING UNIT.

have, however, a secondary object, for below them is the steel bar *c* permanently fixed to the bottom of the barge. The latter is manœuvred entirely by rotating the whole propelling unit bodily, no rudder being required, and as a consequence when the barge is steered any weeds that may have become entangled at the inlet are cut up by the scissors-like action of the guide blades moving over the bar *c*. The pump outlet is at *d*, and a special design of volute chamber was necessary to convey the water from the pump to the point of discharge with a minimum hydraulic loss.

FIG. 3.—ELECTRICALLY-PROPELLED BARGE AT KIDDERMINSTER.

With an ordinary flat-bottomed wall-sided canal barge, 70 ft. long by 7 ft. broad, capable of carrying a 25-ton nominal load, a normal speed of 3.5 m.p.h. is attainable with half power and the manœuvring powers are excellent. Amongst the advantages claimed for the electrically-operated barge are the following:—

The complete power unit and switchgear are portable, that is to say, can be transferred in a few minutes from one boat to another, thus saving dead time occupied in unloading and loading cargo. It is simple, can be started and stopped with one movement of the foot, and requires no skilled operator. The barge can be driven ahead, astern, or sideways with one movement of the hand, the steering and propelling of the barge being carried out by one jet of water from the pump.

The ability to drive the boat sideways is invaluable for getting off a mud-bank and, if the boat is run hard aground at full speed, the jet will quickly cut the mud away from underneath and provide a new flotation for the barge. The propelling jet being driven astern *under* the boat, there is a complete absence of wash when travelling at full speed, thus eliminating any damage to the banks. The reversal of the jet acts as a powerful brake in preventing collisions.

No engine room, which cuts down the cargo-carrying space, is needed, the whole unit being entirely open to the weather. The first cost is low, bearing in mind the advantages of portability, and the operating costs are very reasonable. The pump will permit stones, bricks, bagging, decaying animal matter, in fact anything that will enter the suction, to pass through without injury.

The overhead trolley wires provide a constant supply

of power to any number of barges and the reliability of the modern electric motor, as compared with internal combustion engines, is too well-known to need comment. Power for canal operations, such as dredging, pumping, &c., would be available at any point and at any time, and the advantages of some measure of illumination in tunnels, at stops, &c., particularly with a view to encouraging night traffic are obvious. The advantages of electric power to operate one of these power units used for tugging strings of boats through any of the long canal tunnels will be readily understood, as it would be quite feasible, in cases like this, where the barges guide themselves against the sides of the tunnel, to control the string of boats from either end.

While no very high efficiency is attainable with jet propulsion, efficiency must not be confused with effectiveness in special cases where extraordinary manœuvring, freedom from fouling the propeller and from weed troubles, restricted space, and minimum projection beyond the skin of the vessel are desiderata. The overhead lines and equipment of the barge are, of course, of an experimental character and lend themselves to improvement, but the plant has sufficed to prove the practicability of the idea and the results obtained are distinctly promising.

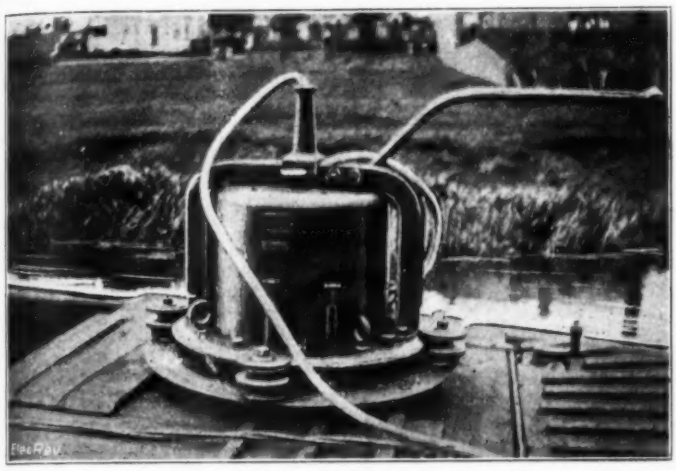

Fig. 4.—Jet Propelling Unit on Barge.

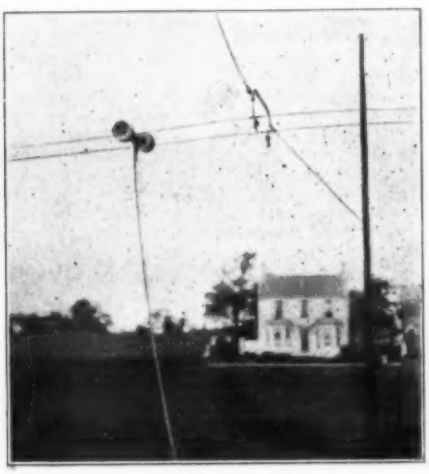

Fig. 5.—Overhead Equipment.

In conclusion, we have to thank Messrs. W. G. Bond and J. T. H. Legge, general manager and chief engineer respectively of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., for affording us an opportunity of inspecting the installation at Kidderminster.

## THE SHIPPING, ENGINEERING AND MACHINERY EXHIBITION.

On Friday last this Exhibition was declared open by Viscount Curzon, M.P., in the presence of many of the leaders of British industry and commerce, the ceremony being followed by a luncheon attended by a large number of exhibitors and guests.

Most of the principal engineering and shipping firms are participants in the show, and the result is a collection of machinery and appliances that will only be excelled by the mammoth display which is in process of preparation at Wembley for next year's great Exhibition.

As we mentioned in our last issue, the electrical industry is very well represented, although several of our leading firms are absent. Makers of generators and motors seem to run very closely for the first place with electric welding firms. Internal-combustion engines are, of course, given a good showing, and there are many stands bearing steam-raising and conserving equipment. An abundance of electrical instruments for industrial and nautical purposes are to be seen, and radio apparatus, which is now an essential in marine work, is shown by a number of firms. It is satisfactory to see that electric cooking and heating are represented, although lighting is, perhaps, not given sufficient attention.

We must once again say that our space is insufficient for an exhaustive survey of everything electrical in the exhibition, but the following notes deal with most of the leading features from the electrical point of view.

Messrs. Siemens Bros. & Co., Ltd., in association with Messrs. Elliott Bros (London), Ltd., have an interesting display of ships' telegraphs and aids to navigation. The engine room telegraphs shown are operated from their own batteries, and are thus independent of the ships' mains. Another exhibit is a revolution indicator which indicates on the bridge the actual movements of each engine. The action, being inductive, dispenses with rubbing contacts and is therefore sparkless. It operates by the action of two brass rings upon the propeller shaft revolving between magnet poles, a cam switching device diverts the current thus generated into either the "ahead" or "astern" portions of the visual indicator on the bridge. A similar device is actuated by a small magneto generator driven by a chain from the propeller shaft, and indication is by means of a moving coil voltmeter, with central zero, graudated to read r.p.m., ahead or astern. One dry cell is used to operate the helm indicator which is exhibited. This instrument shows the angle taken up by a ship's rudder, and it consists of a rheostat, the arm of which is connected to the rudder by means of levers and links, and moved by every displacement of the rudder, the result being communicated by changes of current to a visual indicator, graduated in degrees, fixed on the bridge. Another instrument, or equipment, shown is a "look-out" indicator by means of which the look-out man on a vessel can draw the attention of the navigating officer to any object which he observes. It consists of a transmitter, fixed to the forecastle or in the crow's nest, and a receiver, placed on the bridge or in any other convenient position. The transmitter has a pointer which is brought round to the direction of the observed object and a switch is pressed to transmit the direction to the receiver, and at the same time a bell or buzzer is sounded. When the officer on the bridge has received the warning he presses a switch and thus notifies the watcher that he has received the message. A large number of other instruments and apparatus are shown, among which may be mentioned a navigation light indicator; a Forbes log (described in our issue of July 7th, 1922, p. 28); loud-speaking telephones; a torsion meter for ascertaining the power transmitted to a propeller; ships' radio transmitting and receiving

sets; electrical distance thermometers; pyrometers for internal combustion engines; temperature recorders of various patterns; batteries; electric lamps, &c.

Messrs. Joseph Booth & Bros., Ltd., exhibit examples of their industrial trucks and a battery locomotive. The two-ton truck shown is equipped with a 161 Ah, 20-cell, "Ironclad Exide" battery, supplying a specially-designed motor with a continuous rating of 2¼ h.p., which can develop 4 h.p. for one hour, and up to 7 h.p. intermittently. It is mounted just behind the front axle and transmits its power by a cardan shaft with "universal" clutches to the rear axle. The controller is arranged to give three speeds in either direction, and is so fitted as to render it easily removable for attention. The brake is interlocked with a patent quick-break switch which cuts off the current immediately before the brake is applied, and the current cannot be re-applied until the brake is released and the controller drum returned to the neutral position. A speed of 5 m.p.h. is obtained with full load on a level surface. A similar truck fitted with an elevating platform is shown. The locomotive which is on view is the 10-ton type, although the firm produces locomotives to deal with loads up to 100 tons. The drive is provided by a totally-enclosed, series-wound motor of 2½ h.p. continuous rating, supplied from a 190 Ah battery. The controller is similar to that fitted to the trucks, and gives three speeds in either direction. If desired this locomotive can be arranged for current collection from a third rail or overhead trolley wires. In both trucks and locomotive all rotating parts are mounted in ball bearings.

The Sprecher & Schuh Co.'s principal exhibit is a mast transformer cabin (fig. 1) completely equipped and mounted on two transmission line poles, the line being stretched right across the stand to terminate at the other end in the line sectioning switch also mounted on the top of a pole. The cabin is of sheet iron and the transformer, which need not necessarily be of the outdoor type, protrudes through the base of the cabin so that the terminals are protected against atmospheric influences. The high-pressure line terminates on the

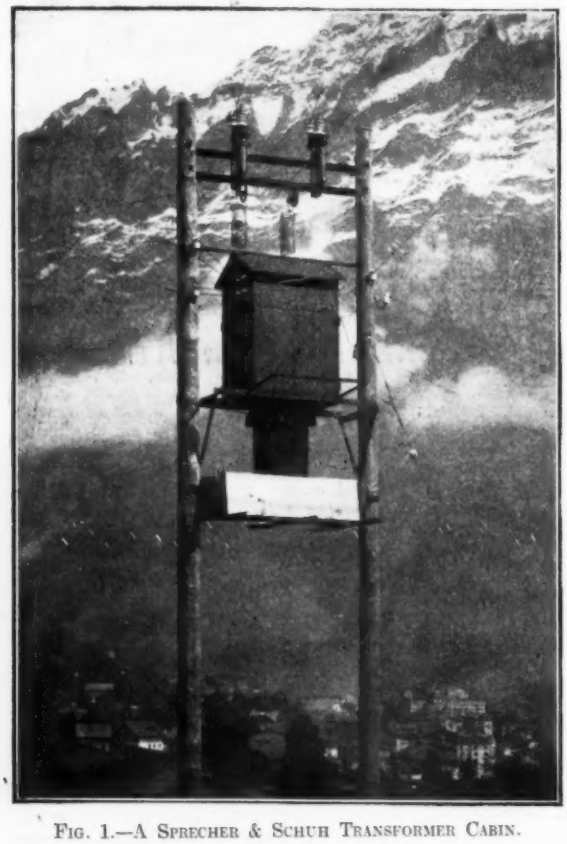

Fig. 1.—A Sprecher & Schuh Transformer Cabin.

top of the cabin in suitable bushings. The primary side of the transformer is protected by three high-pressure expulsion type fuses. The secondary side of the transformer as well as the distribution lines are equipped with porcelain handle type fuses, and the low-pressure leads are taken out of the cabin through suitable porcelain pipes. Doors are provided at either side of the cabin to give access to the interior, and a folding platform with safety rail enables the operator to attend to his duties without danger. Above the cabin the lightning arresters are fitted, consisting of horn type spark-gaps in combination with earthing resistances. The latter are preferably made of carborundum rods contained in an earthenware protecting tube, so as to be ready for operation in all possible climatic conditions.

The line sectioning switch is of the horn type, designed for a permanent carrying capacity of 200 A at 12,000 V, and it is capable of breaking this current at full voltage with perfect safety to the operator, and without danger to the switch itself. The framework consists of tubes which are built together by mechanical clamps forming an absolutely rigid construction. The operating lever is contained in a cast-iron case fixed at such a distance as to be within easy reach of the operator. The switching operation must be fully completed before the operating mechanism can be closed; the switch cannot be left in an intermediate position.

The exhibit also includes some oil switches of modern design with large breaking capacities. One of these switch groups is fitted with direct high-pressure overload release. The other two groups are fitted with electrical remote control.

The remainder of the exhibit consists of high-pressure apparatus including horn type lightning arresters, choke coils, isolating switch, line support, and fuses, and a high-pressure feeder panel equipped with instruments and electrical remote control for the oil switches.

The British Thomson-Houston Co., Ltd., exhibits representative examples of its ignition and lighting sets.

For 8, 9, 12 and 14-cylinder marine engines, the magnetos exhibited are of the "polar inductor" type, in which the windings are carried on a stationary laminated iron core built into the main body of the magneto, resulting in a very strong mechanical and electrical construction. Four sparks per revolution are produced by the flux reversals induced in the stationary windings by the magnetic inductor.

Magnetos for single-, twin-, V-twin-, three-, four-, and six-cylinder engines are of the rotating armature type. Laminated iron pole pieces are die cast integrally with the main housing and distributor endplate, ensuring extreme accuracy in machining and assembling. The contact breaker cams are machined from a continuous ring to ensure accurate spacing and form. The distributor wheel carries a rotary safety spark gap so that ionisation of the air gap is eliminated, while the distributor is of the "jump spark" type to prevent "tracking" troubles, and to act as a spark amplifier. These magnetos can be supplied for either base or spigot mounting.

Impulse starters are shown. A simple mechanism is introduced between the drive and the magneto and, after temporarily arresting rotation for a predetermined period, rapidly rotates the armature producing an intense spark at the plug points.

Lighting generators of the permanent magnet type are also exhibited, as well as the "Sparklight" combined ignition and lighting set for single-cylinder, two-, and four-stroke engines, which acts by utilising the "idle half-wave" of the magneto for charging an accumulator which in turn provides current for lighting. This set is supplied complete with magneto, battery, lamp, and cables.

Messrs. Moorwoods, Ltd., have, as their principal exhibit, a large oil-fired ship's cooking range, but apart from this the stand is electrical. A number of electric fires are on view.

Fig. 2.—The Moorwood No. 3 Cooker.

These, as well as being highly finished, are fitted with the "Moorwood" patent element, for which a number of advantages are claimed. In this element the nichrome strip is not coiled in the usual way but is made up in corrugated form,

which gives an increased heating surface. The turns are secured by strong clips, which pass through the fireclay base and are turned over at the rear. These are easily removable to permit the closing up of a stretched or distorted length. A specially-made white fireclay is used for the base, which does not discolour under the influence of time and temperature. An interesting exhibit is an Admiralty coal stove which, by simple alterations, has been converted into an electric fire. The firm also shows electric cooking apparatus, including the cooker shown in fig. 2. This is so constructed as to allow easy access to all parts. The main oven element is situated in the bottom, but there is also a top element for quick cooking operations, making the total oven loading 2,500 W. In the top are two boiling plates (1,300 W each), and a grill (1,300 W), and the top plate is hinged at the back, permitting it to be swung over for the removal of the elements or the cleaning of the reflector plates with which they are provided. The fuses are all well shielded and the three-heat switches fixed in convenient positions. All connections are made with solid flat strip and all current-carrying parts are covered in.

The Premier Electric Welding Co., Ltd., shows several examples of its equipment. One of these is a multiple d.c. arc welder, the most important part of which is the "drooping characteristic" generator, which gives a high initial voltage for the starting of the arc. To enable three operators to use the plant at the same time a main motor-driven welding generator, compound wound, giving a current at from 30 to 40 V, is provided. Attached to this, on the same bedplate, is a smaller generator of the exciter type, which supplies energy at about the same voltage. When the plant is not in use these two machines are connected in series, giving a combined pressure of about 80 V. Immediately welding is commenced a solenoid-operated switch cuts out the small dynamo, but directly welding is finished the switch re-closes and again connects the two machines in series. Thus an arc-striking voltage of anything up to 80 is provided, while the ordinary welding pressure remains at about 40 V, dispensing with the large resistances which are often used.

A somewhat similar device is employed in the a.c. welding plant, which is also on view. In this the secondary winding of the transformer is split into two portions, one giving the normally-required current at a pressure of 30 V, while the other acts as a booster to give a small current at about 45/50 V for starting purposes. A special contactor device is used to cut out the latter portion when the arc is started, returning to series connection when operations cease. An efficiency of 80 per cent. is claimed for this plant. The other equipment shown includes 5.8 and 4.4 kW sets for single-operator welding, as well as numerous samples of electrodes.

Hesco, Ltd., has on its stand, which is devoted to goods-handling apparatus, a "London" electric truck of 2 tons capacity. This is equipped with a 3-h.p. Verity motor running at 1,700 r.p.m. on 44 V. The battery is a 20-cell "Ironclad-Exide" of 161-Ah capacity. The truck has a loading platform measuring 7 ft. 6 in. by 3 ft. 8 in. As is usual, the controller is kept in the "on" position by the driver and cuts out when pressure is released. A useful adaptation of this truck is

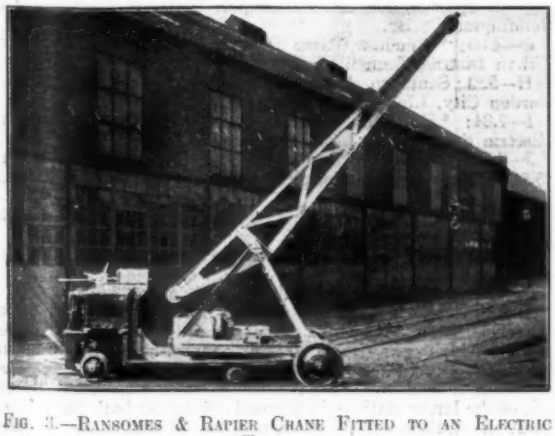

Fig. 3.—Ransomes & Rapier Crane Fitted to an Electric Truck.

shown. A crane body, made by Messrs. Ransomes & Rapier, Ltd., is fitted in a simple manner, and in this way an effective mobile crane is rendered available. A gate controller is fitted, which enables the load or the jib to be raised and lowered by power, or the load to be lowered by gravity. The gate lever causes a series of clutches to be released or engaged; all movements are operated by a single motor. The crane is pivoted on the truck and has, therefore, a considerable scope for slewing independently of the truck. A view of the combination is given in fig. 3. It will be understood that the application is not confined to one particular make or size of truck.

The Electro-Mechanical Brake Co., Ltd., displays a large selection of its steel-cased drum controllers and unbreakable, jointless, and rust-proof resistances. A foot-operated capstan controller is shown. This is arranged for fixing beneath the floor or ground level of docks, wharves, railway sidings, &c., with a spring-loaded shaft and pedal projecting. The pedal is so arranged that the operator is compelled to make a definite pause on every notch, and is thus prevented from passing over a notch. When the pedal is released the controller returns to the "off" position automatically, opening the motor

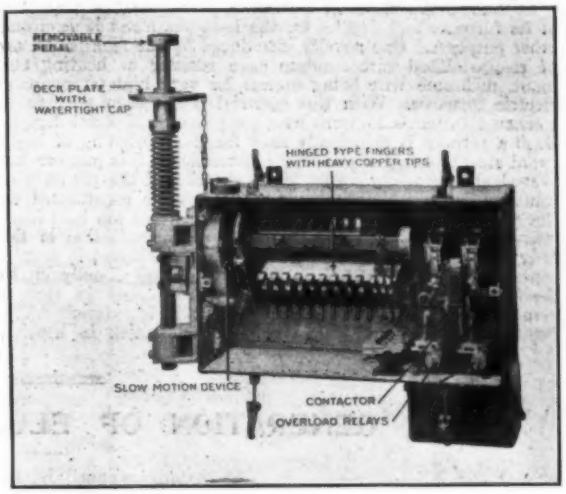


Fig. 4.—An E.M.B. Pedal-operated Capstan Controller.

circuit. A contactor-type circuit breaker is embodied in the equipment and no-volt and overload releases are provided. The d.c. type is equipped with magnetic blow-out over all fingers on the accelerating drum. The controller illustrated in fig. 4 is designed for use with a 3-phase slip-ring induction motor.

The Electric Submerged Log Co. exhibits a device invented by a former officer of the Russian Navy for recording the travel of vessels. This is an electro-mechanical arrangement, which is fitted to the submerged hull of a ship away from wave and propeller disturbances. The instrument comprises two main parts, one inside and the other outside the vessel. The first portion consists of a tube fitted with a stuffing box at the top and a sluice valve at the bottom. The tube has an extension piece to the exterior of the vessel and between the two parts is the above-mentioned sluice valve. The extension ends in a circular casing in which a propeller-shaped rotor operates. Through the instrument runs an insulated wire to a contact in the rotor casing. The rotor is arranged to make 20 revolutions per mile and by means of a make-and-break disk sends a continuous series of impulses to a distance-recording dial graduatel in 20ths of a mile, constructed to measure distances up to 10,000 miles. Speed is not gauged automatically but measured by the combination of a buzzer device, actuated by the mechanism, and a stop watch, with the aid of a table of speeds. The necessary energy is provided by a 6-V dry battery, which is sufficient for a 50,000-mile run.

Messrs. Laurence, Scott & Co., Ltd., show cargo winches, steering gear, motors, and generators. One of the winches is a 3-ton model driven by an electric motor through worm-gearing. The motor is specially designed for the work, mica being liberally used in its construction. It has a heavy shaft and is capable of carrying severe overloads without being unduly stressed mechanically. The shunt and control windings are arranged for continuous rating with a maximum temperature rise of 80 deg. F. By means of a "load discriminator" device the speed is automatically controlled in relation to the load. Excessive speed at any load is prevented automatically by means of speed-limiting shunt coils and a mechanical centrifugal brake. An all-electric steering equipment is shown by the firm. In this a motor-generator run from the ship's mains is employed to provide energy to the main motor of the steering gear. The control of the last is effected by the Scott patent bridge control. This is arranged on the Wheatstone bridge principle, but the place of the galvanometer is taken by the field winding of the exciter connected to the generator of the m.g. set. One resistance (forming two legs of the "bridge") is in the wheel-house, and another in the steering-engine compartment. These resistances are varied by a slider, which is fed backwards and forwards by a lead screw. The screw of the rheostat in the wheel-house is connected up to the wheel so that any movement of the wheel displaces the slider, and thus upsets the electrical balance, causing current to flow through the exciter field winding. The other rheostat is mounted on the main steering-gear motor, from which it is driven by reduction gearing, the pitch of the lead-screw being arranged to suit this. The result of the current flowing

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in the exciter field is that the exciter supplies current to the generator shunt. This machine then supplies energy to the main motor armature, the voltage depending upon the degree of displacement of the wheel rheostat and the consequent strength of the generator shunt. The movement of the main motor armature also moves the rudder rheostat in such a sense as to bring its slider into coincidence with the new position of the wheel rheostat slider. When these two coincide the exciter field loses its current and consequently the generator is unexcited and it and the main motor come to rest. Safeguards are provided against over-running by the rudder.

AUTOMATIC AND ELECTRIC FURNACES, LTD., exhibits a number of its furnaces and muffles for the heat-treatment of steel and other purposes. One novelty introduced by the firm is the use of re-crystallised carborundum as a resistor or heating element, nichrome wire being useless for very high-temperature electric furnaces. With this material it has been possible to construct furnaces to work at a temperature of 1,300 deg. C. Such a furnace is principally used for the hardening of high-speed steel tools. The use of gas furnaces for this purpose has proved unsatisfactory owing to the reaction of the products of combustion upon the steel. The furnaces are constructed on the ordinary muffle principle, but the roof and top heat insulating material is removed to permit the introduction of the re-crystallised carborundum heating rods, which rest in special contacts. These resistor rods radiate the heat directly on to the floor of the muffle chamber, and are placed in such a manner that complete and uniform heating is assured. The furnaces are economical and comparatively quick in heating up. With a chamber measuring 4 in. by 3 in. by 2 in. the consumption is 4.5 kW. In the largest size—in which the chamber dimensions are 9 in. by 5 in. by 3 in.—the consumption is 9 kW. The method of operating this type of furnace is to switch on the current, cut out the resistance, and allow the furnace an hour in which to reach the working temperature of 1,300 deg. C., after which the temperature is regulated in the ordinary way by means of the rheostat provided. Higher temperatures reduce the useful life of the resistor bars. The new type of internally-heated furnace shown, in which the chamber is built up of interlocking fire-brick with longitudinal grooves containing the heating wires, was described in our issue of July 13th last (p. 50). Other exhibits are "Wild-Barfield automatic hardening furnaces—vertical and horizontal—laboratory muffles, and air-tempering muffles.

THE LONDON ELECTRIC FIRM has a varied collection of electrical appliances. Among these are 20-in. and 24-in. ships' searchlights with hand- and automatically-fed lamps, and parabolic silvered glass reflectors. These projectors have balanced trunnions and specially-enclosed lamp boxes, and they are arranged for easy access to the interiors. Another projector shown is fitted with a split reflector, which divides the beam into two portions with a dark patch in the centre, preventing inconvenience to the pilot of an on-coming ship. A 16-in. projector for mounting on a chart-house or pilot's cabin is shown. The control gear for this is contained within the cabin. Other types of projectors are on view and the firm's subsidiary—THE ELECTRIC HEATING CO.—displays domestic electrical appliances.

*(To be continued.)*

# THE GENERATION OF ELECTRICITY IN GREAT BRITAIN.

## Fuel Consumption and kWh Generated during 1922-23.

ON April 13th last we abstracted, at considerable length, the Electricity Commissioners' analyses and summaries of the returns of fuel consumption and kWh generated for 1921-22—just twelve months after the close of the year concerned. To-day we review the data for the year which ended on March 31st, 1923, issued at an interval of only five months, including the holiday season—an achievement on which we think the Electricity Commissioners and their staff are to be cordially congratulated. Anyone who has circularised the electricity works of the country, and understands the difficulty of securing returns promptly, will appreciate the efficiency which is indicated by this speedy performance.

This is the third year for which the return has been issued, and in view of the general approval of the form adopted on the last occasion, the Commissioners have, in general, followed the same procedure in the present instance. They have, however, made the following modifications: Finding that the authorities concerned had no objection to the inclusion of the names of the leading stations in the various categories, they have inserted them; comparisons have been made only between stations having similar ranges of output and methods of generation; and where the calorific value of the fuel used is not specified in the return, the Commissioners have adopted the average calorific value of the same class of fuel used at all other stations in the same district. Incidentally, they point out that undertakers who do not know the calorific value of their fuel should, in their own interests, take steps to ascertain it.

During the year returns were received in respect of 532 stations, and of these 451 have been placed in class order, the remaining 81 being *hors concours* for various individual reasons. As compared with the previous year, the total output showed an increase of 854 million kWh, or 17.5 per cent., whereas the total consumption of fuel showed an increase of 203,637 tons, or only 3 per cent. The average consumption of fuel at steam stations was reduced from 3.11 lb. to 2.78 lb. per kWh generated, showing a saving of 10.6 per cent.; and at oil stations it was reduced from 2.08 lb. to 1.72 lb. per kWh generated, a saving of 17.3 per cent. Gas producer stations, on the other hand, showed an increase from 2.64 to 2.70 lb. per kWh generated, an increase of 2.2 per cent.

Under the heading of "Steam Stations" 392 stations are included, compared with 396 in the previous year, in 13 groups, according to output; the total output of these was nearly 5¼ million kWh (4¼ in the previous year), and the total fuel consumed amounted to 6,788,306 tons at an average rate of 2.78 lb. per kWh (6,577,587 tons at 3.11 lb.). At the head of the first group, comprising three stations of over 200 million kWh annual output, with a fuel consumption averaging 2 lb. per kWh, stands the Carville "B" station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., with a consumption of 1.74 lb., and a thermal efficiency of 17.80 per cent. The next group comprises six stations, with an annual output of more than 100 million kWh each, averaging 2.25 lb. per kWh, and here again the same company has the best record with 1.91 lb. and 16.50 per cent. at Dunston power station. Group C includes 16 stations of 50 to 100 million kWh, averaging 2.68 lb., and again the Newcastle company leads, its North Tees station claiming the best fuel record in the country, with 1.73 lb. per kWh, but coming second to Carville "B" with 17.15 per cent. thermal efficiency. Group D, in which there are 34 stations between 25 and 50 million kWh, has the largest aggregate output of all the groups (1,211 million kWh), at an average fuel consumption of 2.63 lb. per kWh; Blackburn Meadows Station of Sheffield Corporation, and No. 2 station of Rotherham Corporation are bracketed with 1.98 lb. per kWh, the latter having a thermal efficiency of 16.70 per cent. In group E, containing 65 stations of 10 to 25 million kWh, averaging 3.03 lb., Hackney Borough Council comes first with 2.05 lb. and 15.40 per cent. The five groups above-mentioned include 124 stations generating 88 per cent. of the total output of steam stations (4,800 million kWh), and consuming 5¼ million tons of fuel at an average of 2.57 lb. per unit; the group average consumption ranges from 2 to 3 lb. The remaining groups comprise the smaller stations, from 10 million down to 50,000 kWh generated per annum, numbering 268, and the relative statistics are briefly as follows (group fuel average, best average, best efficiency):—

F—3.73; Brompton and Kensington (2.42), Twickenham and Teddington (11.72).

G—4.35; *Finchley Urban District Council (2.82), Finchley Urban District Council (11.20).

H—5.21; Southern Railway, Southampton Dock (3.18), First Garden City, Ltd. (9.95).

I—7.34; *Horsham Urban District Council (4.08), Urban Electric Supply Co., Ltd., Grantham (7.22).

J—7.73; Electricity Supply Corporation, Ltd., Falmouth (5.16), Edmundson's Electricity Corporation, Ltd., Dorking (5.62).

K—13.22; Dawlish Electric Light & Power Co., Ltd. (5.30), ditto (5.45).

L—15.85; *Ross Electric Light & Power Co., Ltd. (10.73), ditto (2.64).

M—30; L.N.E. Railway, Silloth (3.53), ditto (7.61).

The Newcastle company is entitled to congratulations upon the excellent results which it has attained in the first three groups, which comprise 25 stations generating over 50 million kWh per annum. Sheffield and Rotherham, allowing for the handicap of smaller output, run it very close, the latter beating one of the larger stations in thermal efficiency; both these Corporation stations are practically new. Hackney heads the Metropolitan area with credit, having an average fuel consumption almost identical with the average of the three stations in group A.

The general average of 2.78 lb. compares well with that of the preceding year, 3.11 lb., and as the newer power stations come into full operation we may confidently expect to see a further material improvement in this figure.

"Gas Producer Stations" are 61 in number, an increase of one, and generated in all 15¼ million kWh with a total consumption of 18,437 tons of fuel, at an average of 2.70 lb. per kWh—practically the same as the steam stations, but not so good as in the previous year (2.64). None of these stations had an output exceeding 2½ million kWh. The aggregate out-

* Composite stations.

put in the previous year was nearly 15 million kWh. In group H, with an average consumption of 1.70 lb. per kWh, *Guernsey E.L. & P. Co., Ltd., heads the list with 1.55 lb. and 16.50 per cent. The other groups are given below :—

I—3.14; Minehead Electric Supply Co., Ltd. (2.18), ditto (11.16).

J—3.26; Trowbridge Electric Supply Co., Ltd. (1.68), ditto (12.62).

K—2.56; Chippenham Electric Supply Co. Ltd. (1.48), ditto (14.40).

L—2.90; *Ledbury Electric Supply Co., Ltd. (1.81), ditto (11.77).

M—3.65; *Leominster Electric Supply Co., Ltd. (2.60), L.M.S. Railway, Normanton (8.50).

It will be noticed that the figures show little relation between output and efficiency.

"Oil Engine Stations" number 52, the same as in the previous year, and produced 28 million kWh—a reduction of 4 millions; a much larger reduction in fuel took place, from 25,396 to 21,545 tons, the average being 1.72 lb. per kWh, as compared with 2.08 lb. Here again the relation between output and efficiency is variable, but the best results as regards both fuel consumption and thermal efficiency are remarkably good :—

H—1.88; Electricity Co. of Macclesfield, Ltd. (0.65), ditto (28.10).

I—1.69; East Anglian Electricity, Ltd., Felixstowe (0.63), ditto (29.10).

J—1.57; Sale U.D.C. (0.69), ditto (27.45).

K—1.14; Frinton-on-Sea E.L. & P. Co., Ltd. (0.73), ditto (35.50).

*Composite stations.

L—1.10; Windsor Electrical Installation Co., Ltd. (0.82), ditto (23.00).

M—1.94; L.N.E. Railway, Mallaig (1.84), ditto (9.50).

Of stations generating by waste heat (17), refuse destruction (28), town's gas (9), and water power (27), 81 in all, the majority are "composite" and are therefore included in the foregoing statistics. The aggregate outputs under each heading are from waste heat 184 million kWh (1921-22, 55 millions), destructors 21 millions (18 millions), town's gas 3 millions (4 millions), and water power 32 millions (29 millions), making in all 239 million kWh as compared with only 105 millions in the previous year. It is pleasing to note that the energy recovered from waste heat was more than trebled in amount, this accounting for almost the whole of the aggregate increase.

Tables are given showing the best results obtained at stations of each size and class in all the areas dealt with, and the kWh generated and fuel consumed in each area. From one of these it appears that the respective sources of energy are employed as follows, in terms of the aggregate output from all sources: Steam, 95.08 per cent.; producer gas, 0.26; oil, 0.49; waste heat, 3.21; refuse, 0.36; town's gas, 0.05; water power, 0.55 per cent. The area in which most energy was generated was No. 7 (London & Home Counties Electricity District), 1,562 million kWh; second in importance was No. 16 (Durham, Northumberland, and parts of Yorkshire), 850 millions; and third, No. 3 (South-East Lancashire Electricity District), 647 million kWh. The only other area exceeding 350 millions was No. 81 (West of Scotland Electricity District), 413 millions.

The returns are now obtainable from H.M. Stationery Office, price 1s. 6d. net.

## BUSINESS NOTES.

**Bankruptcy Proceedings.**—GEORGE REGINALD TOPLISS, 9, Palatine Chambers, Halifax, Yorkshire, electrical engineer.—The first meeting of creditors in this matter was held recently at the County Court House, Prescott Street, Halifax. The liabilities were stated to be £364, with a deficiency of £327. Debtor attributed his failure to bad trade and expenses too heavy for turnover. The case being a summary one, was left in the hands of the Official Receiver as trustee.

C. W. STOCKEN & C. FINK (Wyndham Radio Supplies), 80, Redcliff Street, Bristol.—Receiving order made August 27th on debtors' own petition.

C. F. M. METCALF (C. F. Metcalf), electrical engineer, 8, Cow Green, Halifax.—First meeting September 10th. Public examination October 12th, both at the County Court House, Prescott Street, Halifax.

T. DAVISON (Radio Technical College), 30, Falkner Street, Liverpool.—First and final dividend of 3s. 4d. in the £, payable September 12th at the offices of the Official Receiver, 11, Duke Street, Liverpool.

ARTHUR CHARLES ALEXANDRA (A. C. Alexandra & Co.), mechanical and electrical engineer, 10, Iddesleigh House, Caxton Street, Westminster, S.W.—The first meeting of creditors was held on September 3rd at the London Bankruptcy Court before Mr. E. Parke, Official Receiver. The receiving order was made on August 20th upon the petition of the Omega Lamp Works, Ltd., Wimbledon. The chairman reported that it appeared from the debtor's statements that he served his apprenticeship with a firm of electrical engineers at Chelmsford from 1891 to 1895, and was subsequently employed by various firms. In September, 1920, he commenced business on his own account at Pilgrim Street, Newcastle-on-Tyne, under the style of A. C. Alexandra & Co., and traded with success until January, 1922, when he converted the business into a limited company, registered as A. C. Alexandra & Co., Ltd., with a nominal capital of £10,000. As vendor he received £6,000 shares and he acted as managing director until the following July, when, owing to disputes with his co-director, he sold his shares for £400 cash and resigned. He then came to London and started business at Iddesleigh House under the style of A. C. Alexandra & Co., with a capital of £400. He built up a good connection, secured some thousands of clients, and in June, 1923, he formed a company, which he again registered as A. C. Alexandra & Co., Ltd., the nominal capital being £20,000 in shares of £1 each. The considerations for the transfer were the issue of 4,000 shares to the debtor and 5,000 to nominees, the company further undertaking to discharge all existing liabilities and giving the debtor an indemnity against all claims in respect of them. The debtor again acted as managing director of the company. According to accounts taken at the time, the liabilities amounted to £4,026 and the assets were valued at £13,026, of which £10,000 was represented by goodwill. The company did not pay the liabilities and some of the creditors sued the debtor for payment and obtained judgment against him personally. Apart from those liabilities, he owed less than £100, and the only assets in his possession were his shares, which were returned as of uncertain value. The debtor attributed his failure to the inability of the company to discharge the liabilities of the business. Mr. Percy Haseldine, on behalf of the debtor, asked for an adjournment of a fortnight, with the view to an offer of composition being submitted to the creditors. That was refused, and a resolution was passed for Mr. E. H. Hawkins, I.A., 4, Charterhouse Square, E.C., to act as trustee and wind up the estate in bankruptcy, assisted by a committee of inspection.

J. HARRIS, electrical and general engineer, King's Head Buildings, Church Street, Coventry.—First and final dividend of 3s. 10d. in the £, payable September 10th at the Official Receiver's Office, 9-11, High Street, Coventry.

SAMUEL LEE BAPTY and NEVILLE MILES, wireless instrument manufacturers, Avenue Works, Avenue Road, Willesden Junction.—The first meeting of creditors was held at the London Bankruptcy Court, on September 4th, before Mr. Walter Boyle, Senior Official Receiver, who reported that 13 proofs of debt amounting to £554 had been lodged. A joint statement of affairs had been presented, showing unsecured liabilities £1,152, and preferential claims £76, against assets consisting of stock estimated to realise £350; machinery, £150; fixtures and fittings, £26; stocks and shares, £7; good book debts, £635; and other debts amounting to nearly £2,000, but treated as bad. In their deficiency account, which dated from June 1st, 1922, the debtors showed a net profit of £645, and a claim to £1,676 for breach of contract, whilst on the other side £1,982 was written off for bad debts, and the partners' drawings of £180 each. The debtor Bapty returned separate liabilities £658, and assets, good book debts, £223, and bad debts £595, whilst the debtor Miles returned separate debts £58, and no separate assets. It appeared from the statements of Bapty that on leaving school he went to Manchester, and was employed by a firm of electrical engineers, his object being to obtain a thorough knowledge of electrical engineering. He came to London in 1915, and joined an electrical firm as an instrument maker. About Christmas, 1919, he commenced business on his own account as a scientific instrument maker and dealer in electrical goods; he traded in his own name at 110, Crawford Road, W., and whilst there secured the patent rights over a blowpipe, which he subsequently sold for £5,000; but he only received £250, and his claim to the balance was disputed. In June, 1922, he commenced business in partnership with the debtor Miles as wireless instrument makers at 132, Northcote Road, Battersea, under a verbal agreement for the profits and losses to be shared equally. The business was successful, and a few months later was removed to Willesden to enable them to carry out a contract for the manufacture of wireless goods for the Modern Electrical Supply Co., Ltd. They traded as "Bapty & Miles," and on removal to Willesden they registered the trading name of the "Wireless Instrument Manufacturing Co." The business was continued with success until November, 1922, when the Modern Electrical Supply Co., which owed them £722 on bills for goods supplied, went into voluntary liquidation. The debtors had discounted the bills with their bankers, and as they were not met, the bank had demanded payment. The Modern Electrical Supply Co. were also debtors for £200 in respect of goods partly delivered and partly held at the company's disposal. Another book debt was owing by the Arc Electrical Co., of Manchester,

in respect of which the debtors had obtained judgment for £503; a receiving order had been made against that firm in the Manchester Court on July 18th. The debtors attributed their present position to their inability to recover the two before-mentioned book debts, in consequence of which they were left without working capital; they were recently pressed by creditors, and on the advice of their solicitors they filed their petition on August 21st. A resolution was passed for Mr. E. H. Hawkins, I.A., 4, Charterhouse Square, E.C., to act as trustee and administer the estate in bankruptcy, assisted by a committee of inspection.

**Company Liquidations.**—A.C. Cutting and Welding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. H. King, 13 and 14, Basinghall Street, E.C. Meeting of creditors, September 11th, at the office of the liquidator, to whom particulars of claims should be sent by September 30th.

Premier Electrical Supplies, Ltd.—Winding up voluntarily. Liquidator, Mr. T. C. Payne, 80, Lancaster Road, West Norwood, S.E. Meeting of creditors, September 12th, at Pagani's Restaurant, 42, Great Portland Street, W.

Premier Electrical Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. H. Mellor, 1, Melbourne Street, Stalybridge. Meeting of creditors, September 18th, at Portland Chambers, Stalybridge. Particulars of claims to the liquidator by October 13th.

Saxby & Farmer, Ltd.—A meeting of members is called for October 5th at 82, York Road, King's Cross, N., to hear an account of the winding-up from the liquidator, Mr. R. Payne.

**Private Arrangements.**—Gordon Wall and Harold Wall, trading as Wall Bros., electrical engineers, High Street, Clacton-on-Sea.—The creditors interested herein were called together on August 24th, at the offices of Mr. H. G. Hamshar, accountant, 49, Chancery Lane, London, W.C., when a statement of affairs was presented, which showed liabilities of £1,665. The indebtedness to the trade was £1,435, while there was a partly secured cash creditor for £100 who held security valued at £60, thus leaving £40 to rank. In addition, there were unsecured cash creditors for £190. The assets consisted of: Cash at bank £2; book-debts £542, expected to produce £439; agreement *re* High Street premises and shop fixtures, £13; and stock at cost £700, estimated to realise £270, making total assets of £723, from which had to be deducted £28 for preferential claims, leaving net assets of £695, or a deficiency of £970. It was reported that the debtors commenced business in partnership in February, 1921. They had little or no capital of their own, and originally they carried on business at Meredith Road. Later they took an additional workshop at a rental of 5s. a week, and a lock-up shop at £75 per annum. In February last they desired to extend the business and entered into negotiations for taking in an additional partner. In anticipation of the extension of the business they appeared to have over-bought, but the negotiations for a new partner fell through. The principal cash creditor was the debtors' father, who was scheduled for £138, and would withdraw his claim if the matter was dealt with under a deed. It was further stated that the debtors had no wish to continue the business, and they attributed the present position to loss on trading since May, depreciation of stock, and lack of capital. No offer of a composition was submitted, and it was decided that the estate should be dealt with under a deed of assignment with Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., as trustee, together with a committee of three of the principal creditors. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Metropolitan - Vickers Electrical Co., Ltd. ... ... ... ... | 215 | Hodson & Co. ... ... ... | 25 |
| Foster Engineering Co., Ltd. ... | 139 | Thomas Frederick & Co. ... ... | 27 |
| Truslove & Co. ... ... ... | 96 | Simplex Conduits, Ltd. ... ... | 30 |
| General Electric Co., Ltd. ... | 84 | Emmanuel & Son, Ltd. ... ... | 26 |
| British Electric Transformer Co., Ltd. ... ... ... ... | 70 | Hoffman Bros. ... ... ... | 10 |
| Telephone Mfg. Co., Ltd. ... | 58 | Gates, E. & C., Ltd. ... ... | 12 |
| Clark, Hunt & Co., Ltd. ... | 52 | Chloride Electrical Storage Co., Ltd. ... ... ... ... | 10 |
| Tucker, J. S., & Co. ... ... | 60 | British Electrical Repairs ... | 17 |
| Lee, Albert, & Co., Ltd. ... ... | 58 | Hoover Suction Sweeper Co. ... | 33 |
| Callender's Cable & Construction Co., Ltd. ... ... ... ... | 46 | Wenham Lighting Co. ... ... | 15 |
| National Electric Supply Co. ... | 69 | Burrows, E. J. ... ... ... | 12 |
| Modern Electric Supply Co. ... | 50 | Clacton-on-Sea Graphic Co. ... | 42 |
| Ferguson & Sons ... ... ... | 20 | Mansell & Co. ... ... ... | 25 |
| | | Dell, A. ... ... ... ... | 42 |

Brooking & Co., electrical engineers, 44, High Street, Exeter; 73, Thomas Street, Weymouth; and The Parade, Exmouth.—A meeting of the creditors was held at the offices of the Incorporated Society of Accountants, 50, Gresham Street, E.C., on August 30th; Mr. Robinson, of Messrs. Robinson, Hand & Co., the largest trade creditors, presided. Mr. Kightly, of Messrs. Judson, Mills and Co. (the trustee of the estate), submitted a statement of affairs, which showed liabilities £4,235, made up of sundry creditors £3,842, and bank overdraft £393. The assets comprised stock in trade estimated at £1,000; book debts £2,383, estimated to produce £2,377; estimated value of contracts not yet completed £1,000, less cash received on account £923; leaving a balance of £74. Installation at Torpoint valued at £120, shares in Torpoint Electric Light Co., Ltd., estimated at £224, plant, machinery, fixtures, and loose plant expected to produce £200, and four acres of freehold land at Margate called "Garlinge" situated between Margate and Westgate £500, making total assets of £4,498, or an excess of assets over liabilities (subject to realisation) of £263. Mr. Kightly informed the creditors that the debtors thought that he (Mr. Kightly) had taken a much too conservative view with regard to the assets; this, however, must be decided by the creditors, as most of them would no doubt be able to make a fair valuation for themselves. Mr. Mills then addressed the meeting, and said there were two partners in the firm, Mr. William Bird and Mr. George Ewings. The business was formed about ten years ago. Mr. Bird was stated to have been at one time a J.P. for Dawlish. When his father died, he left him certain money, and this he put into the business, but it had all been lost. Since the year 1920, the losses on trading had been as follows: £165, £112, and £529. Mr. Mills stated that the debtors had been straightforward in every way. Mr. Ewings was a practical electrical engineer, but the firm knew little about the book-keeping side of the business, and consequently the books had not been kept as they might have been. The recent drawings of the debtors had been £10 each per week. Mr. Mills added that one of the causes that had led to the present difficulty was that a branch of the business had been opened in Dorchester. Soon afterwards, however, the Government forced them to close down this business owing to the war. On this venture they lost £700. They opened another branch at Teignmouth, mainly with a view to a contract for installing electric light in the town. The scheme, however, fell through, and they lost between £400 and £500; this was during 1917. Another branch was started called the Southern Trading Co. This company was formed principally for the purpose of buying surplus Government stocks. This venture also failed, and a further £1,500 was lost. This branch was closed down eighteen months ago. Electric light was installed at Torpoint, and after completing its contract, the firm took as part payment 4,488 shares in the Torpoint Electric Light Co., Ltd., at 10s. each fully paid. The bankers being interested tried to sell them, but could not obtain more than 1s. per share. The business at Exmouth over which Mr. Ewings lived was more of a fancy business than an electrical one. Considerable discussion then took place with regard to the deed of assignment which was executed on August 14th and registered on August 21st. Mr. Houston asked why this deed had been executed without first informing the creditors and obtaining their consent. Mr. Mills replied that the deed was to protect the estate, and he did not see that any harm had been done to the creditors through registering this deed. Asked whether the debtors had any offer to make, the trustee replied that they had made an offer which was as follows: If the debtors continued business, Mr. Bird could obtain a loan of £500 from a friend. At the end of every three months' trading the firm would pay over 50 per cent. of the receipts for the benefit of the creditors and the other 50 per cent. would be for carrying on the business. All goods paid for would be in cash. The debtors were then called into the room and confirmed the offer made on their behalf, and also stated that in their opinion the trustee's valuation of the assets was much too low. After further discussion, a proposition was put forward and carried that the deed of assignment be approved, and that a committee of six of the creditors be appointed to act with the trustee, and that the latter's remuneration be fixed by the committee. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Auckland Son ... ... ... | 14 | Otton, W. T., Ltd. ... ... | 13 |
| Ever Ready Co. ... ... ... | 133 | Rowe Bros., Ltd. ... ... ... | 14 |
| Besley & Copp ... ... ... | 12 | Robinson Hand Electric Co., Ltd. | 896 |
| Brown, S. G., Ltd. ... ... | 26 | Simplex Conduits, Ltd. ... ... | 95 |
| Callender's Cable & Construction Co., Ltd. ... ... ... | 205 | Vandervell & Co., Ltd. ... ... | 102 |
| Cryselco ... ... ... ... | 29 | Wilson & Son, Ltd. ... ... | 10 |
| Claremont, Johnson & Co. ... | 13 | Waygood-Otis, Ltd. ... ... | 30 |
| Drake & Gorham, Ltd. ... ... | 13 | Yeo & Davey ... ... ... | 25 |
| D. P. Battery Co., Ltd. ... ... | 200 | Betts & Co. ... ... ... | 30 |
| Saunders, E. S. ... ... ... | 11 | B.T.T. Electric Lamp Co. ... | 21 |
| Emanuel & Son, Ltd. ... ... | 68 | Conway Theo, Ltd. ... ... | 26 |
| Evans, Gadd & Co. ... ... | 19 | Ormond Engineering Co. ... | 25 |
| Edison Swan Electric Co., Ltd. | 322 | Hooper, G. ... ... ... ... | 90 |
| General Electric Co., Ltd. ... | 225 | Shortman & Co. ... ... ... | 18 |
| General Cable Co. ... ... ... | 46 | Harris Co. ... ... ... ... | 38 |
| Hubber & Son ... ... ... | 12 | Hooper, T. ... ... ... ... | 12 |
| Hoover, Ltd. ... ... ... ... | 84 | Dorset Supply Co. ... ... ... | 17 |
| Pooper, T. ... ... ... ... | 25 | Ross Wholesale Supply, Ltd. ... | 35 |
| Kalamazoo, Ltd. ... ... ... | 17 | *Dorset Daily Press* ... ... | 42 |
| Marconi, Ltd. ... ... ... | 52 | Borough of Weymouth ... ... | 85 |
| Mullard Radio Valve Co. ... | 21 | Electric Light & Power Co. ... | 24 |
| Morgan Electric Motor Co. ... | 83 | Beer, W. W. ... ... ... ... | 45 |
| Newtons, Ltd. ... ... ... | 33 | Rates ... ... ... ... ... | 11 |
| | | Rates ... ... ... ... ... | 24 |

**Dissolutions of Partnership.**—Prestwich & Ball, electrical engineers, 79, Long Street, Middleton.—Mr. V. R. Prestwich and Mr. E. Ball have dissolved partnership. Mr. Ball will attend to debts.

E. B. Parr & Co., engineering, electrical and general pattern model makers, &c., 224, Bermondsey Street, S.E.1.—Mr. E. G. R. Parr and Mr. W. E. R. Parr have dissolved partnership. Mr. E. G. R. Parr will attend to debts and continue the business under the same style.

**Trade Announcements.**—Mr. C. F. Pardoe, electrical and mechanical engineer, Dansom Lane, Hull, informs us that he has opened new premises in Clarence Street, Hull, to which address all communications should be sent.

The Great Northern Telegraph Co., Ltd., of Denmark, on September 3rd changed its address to No. 5, St. Helen's Place, London, E.C.3. Telephone: "London Wall, 3962."

To meet the increasing demand for its various manufactures, Fuller's United Electric Works, Ltd., of Chadwell

Heath, Essex, has opened a London depôt at 58, High Street, W.C.2 (close to Tottenham Court Road tube Station.) Here adequate stocks of "Sparta" and wireless batteries, accumulators, dry cells and wireless accessories, cables and wire, are maintained, and facilities for battery repair and charging are provided. Telephone: "Gerrard 5070."

The Kartret Switchgear Co., Ltd., has just been formed and registered to carry on the sale of the switch and fuse gear hitherto manufactured by the Kartret Engineering Co., Ltd. The address of the old company at 7, Carteret Street, Westminster, is retained. Mr. V. G. Middleton and Mr. C. J. Baker, both of whom have been closely identified with the Kartret gear since its introduction, are directors of the new company.

**Catalogues and Lists.**—Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—A comprehensive list of electrical supplies. Illustrated and priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Folder No. F.3079, containing illustrations and prices of "Gecoray" reflectors for shop-window lighting.

Drake & Gorham Wholesale, Ltd., 36, Grosvenor Gardens, S.W.1.—Pamphlet No. 382, an illustrated price list of lighting fittings for offices, workshops, streets, &c.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—A priced and illustrated catalogue (71 pp.) of all kinds of electrical appliances, accessories and materials.

The Arora Co., Loughborough, Leicestershire.—A postcard bearing an illustration of the new type "Rosebery" electric fire.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., Silvertown, E.16.—A well-illustrated descriptive list of radio accessories.

Burlectas, Ltd., 11, Pancras Lane, Queen Street, E.C.4.—A price list illustrating in colours four examples of "Staines" art-ware for lighting purposes (table standards).

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—A lamp catalogue containing alterations in prices.

Mr. Fredk. Tuckett, 87, The Grove, Broadway, Hammersmith, W.C.—An illustrated leaflet advertising silk and bead lamp shades.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—Pamphlet No. 100 A, giving illustrated descriptions of rolling-drum type air compressors and exhausters.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Bulletin" for August, containing descriptions, &c., of automobile accessories.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—A series of booklets and pamphlets dealing with all types of electric lamps—vacuum, gasfilled, automobile, &c.—and notifying price reductions.

Autoveyors, Ltd., 84, Victoria Street, S.W.1.—An illustrated and priced pamphlet describing a 3-electrode variable condenser.

**Proposed New Vickers Company.**—The Internal Combustion Engineering Corporation of New York is reported to be negotiating with Vickers, Ltd., with a view to the formation of a new English corporation in which the two companies would jointly be interested. The president of the New York concern is expected to sail for England shortly in this connection.—*Reuter.*

**German Price Changes.**—The British Consul-General at Cologne has forwarded to the Department of Overseas Trade the following extract from the German Press of recent date: "Electric Heating and Cooking Apparatus.—The Association of Electric Cooking and Heating Apparatus Manufacturers has given notice that as from August 15th the prices of electric cooking and heating apparatus are to be calculated in gold marks. They will be based on the catalogue prices of March, 1922, with a gold factor of 0.024 for irons, cords and travelling apparatus, and of 0.020 for all other kinds. One gold mark = one dollar divided by 4.20."

**The South African Market.**—The *S.A. Mining and Engineering Journal* of August 11th, reporting upon the market for electrical goods, said: "Last month, dealers state, was a good one and August is shaping all right so far. Prices, both at home and locally, are not appreciably altered.

**The Boilermakers' Lock-out.**—A conference between engineering and shipbuilding employers and representatives of the Boilermakers' Society was held at York on August 29th, to endeavour to arrive at a settlement of the dispute which has been in progress for four months. The conference lasted four hours, but it was announced that no basis of agreement had been arrived at, and the conference was adjourned *sine die*.

**Swedish State Railway Contracts.**—The State Railways have begun the distribution of orders for the material needed for the electrification of the line from Stockholm to Gothenburg. The following are among the orders placed:—Svenska Metallverken, copper wire to the value of Kr. 3,000,000; Domnarvets Jaernverk, 500 tons of iron; and Ljunggrens Verkstaeder, at Kristianstad, 800 contact poles and other constructional iron work. The time for the receipt of tenders for 50 electric locomotives expires on December 1st, and for converter stations on December 10th.—*Reuter's Trade Service* (Stockholm).

**Catalogues for Mexico.**—His Majesty's Consul-General at Mexico City (Mr. N. King) draws the attention of British traders sending catalogues to Mexico to the necessity for arranging for the payment of the recently-imposed duty on such literature. Delivery is not permitted before this duty has been paid.

**British Catalogues for Canada.**—His Majesty's Senior Trade Commissioner in Canada (Mr. R. W. Dalton) has informed the Department of Overseas Trade that there is a serious lack of British catalogues in the various Trade Commissioners' offices in Canada. He points out that without such catalogues it is often a difficult matter to advise firms in Canada as to possible British sources of supply, and that the necessity of referring inquiries to headquarters in London takes time, during which business that might otherwise have gone to British firms is lost to them.

United Kingdom firms desirous of ensuring that their names shall be given to suitable inquirers should forward copies of their catalogues to the following:—

H.M. Senior Trade Commissioner in Canada, 285, Beaver Hall Hill, Montreal.
H.M. Trade Commissioner, 24, Adelaide Street West, Toronto.
H.M. Trade Commissioner, 210, Winch Building, Vancouver.
The Chief Clerk, Office of H.M. Trade Commissioner, 703, Union Bank Buildings, Winnipeg.

Customs duty is levied on catalogues entering Canada, and firms desiring to send them by parcel post should prepay such duty. For this purpose stamps may be obtained from the office of the High Commissioner for Canada, Kinnaird House, Pall Mall East, London, S.W.1.

**Latvian Trade.**—At the third exhibition and sample fair recently held in Riga, says the Correspondent of the F.B.I. in that city, the majority of the exhibitors were Germans; the number of British firms represented was again very small. The efforts which Germany is making to obtain a footing in the Baltic market may be illustrated by the fact that German firms are quoting in Latvian currency, and are corresponding in Lettish. They are even printing their catalogues and pamphlets in that language.

**Canadian Patent Regulations.**—An Act to amend and consolidate previous Acts relating to patents was put into force on September 1st by the Dominion Government.

From a summary of its provisions, published in *Commerce Reports*, it appears that inventions of process are now made patentable by statute; by the previous law, a patent could be granted only for "any new and useful art, machine, manufacture or composition of matter," or improvement thereof. An invention will not be considered new, and, therefore, is not patentable, if it has been patented or described in a printed publication in Canada or any foreign country; or if it has been in public use or on sale in Canada for more than two years prior to application in Canada. (The former period was one year.) If application is made in Canada within twelve months following application in any country affording similar privileges to Canadian citizens, it shall have the same effect as if it had been filed on the same date on which such foreign application was made. This allows a priority period of twelve months during which the foreign applicant may assert prior claim over all other applications filed during the interval. This priority period is the same as that provided for in the Convention of 1883 for the Protection of Industrial Property, of which Canada is not a member. (By the Act of 1906, the priority period was three months from the date of issue of the foreign patent.)

The regulations requiring the manufacture of the invention have been modified. If working of the invention is not begun by the patentee within three years of the date of the patent, to such an extent that the reasonable requirements of the public are met, the patentee may be ordered to comply with this requirement under pain of forfeiture of the patent. By the previous Act, the patent could be declared null and void if manufacture of the invention were not undertaken and carried on in Canada within two years of the date of the patent, unless the patentee had reasonable cause for not doing so.

**Unemployment.**—The number of persons recorded on the live registers of the employment exchanges in Great Britain as wholly unemployed on August 27th was 1,228,200. This was 4,911 more than in the preceding week, but 257,678 less than the figure recorded on January 1st last. The number working short time and drawing benefit for intervals of unemployment on August 27th was 65,900, as compared with 66,290 on August 13th, and 56,261 on January 1st.

**Trade Union Membership.**—The figures of the membership of the societies represented by the Trade Union Congress, presented this week at the Plymouth meeting, show that during 1922 there was a falling-off of 2,048,647, or 30 per cent. The engineering unions show a fall of about 150,000 members—the present total being 443,000. Transport workers' unions—apart from railways—have lost only 2,000 members, the present membership being given as 406,000. The membership of general workers' unions shows a severe decrease—from 655,000 to 390,000. On the other hand, public employés have risen from 139,000 to 170,000, due, perhaps, to unemployment relief schemes

**New Peruvian Tariff.**—From a list of the new import changes formulated by the Peruvian Government, recently published in *Commerce Reports*, it is apparent that many reductions have been made, although the duties on many articles for domestic use have been increased. Machinery for mining or agricultural purposes is to be entirely free, and other machinery is to be admitted at materially-reduced rates.

**Irish Contractors' Outing.**—About 100 members of the electrical and allied trades visited Dunsey Island, Strangford Lough, Co. Down, on August 28th, on the invitation of Mr. Guy L. Birch, chairman of the Ulster Branch of the Electrical Contractors' Association. The party journeyed by motor car to Rinhaddy and thence by motor launches to Mr. Birch's residence on Dunsey Island. The party included Mr. Robert Robson (president of the Electrical Contractors' Association, Incorporated), Mr. Leonard G. Tate (secretary), and Mr. Johnstone Wright, M.I.E.E. (Belfast City Electrical Engineer).

**"Supplementary Wages."**—Payment has been announced by the General Electric Co., U.S.A., of 5 per cent. supplementary compensation for continuous service to all employés of the company receiving $4,000 or less per year who had completed five years or more of continuous service on June 30th last. The current payment amounts to $1,119,300, and the total number of employés to benefit is 26,324. Payments are being made in 8 per cent. bonds of the General Electric Employees' Securities Corporation, in multiples of $10, the balance, if any, in cash.—*Electrical World.*

**Labour and Co-Partnership.**—At this week's session of the Trade Union Congress, at Plymouth, a resolution was to be submitted declaring that the attempts to introduce forms of co-partnership were designed to mislead workers and prevent trade union "solidarity." The Congress was asked to declare itself against any form of co-partnership. This was somewhat tempered by an amendment brought forward by another union instructing the General Council to investigate the whole question of co-partnership—its advantages and disadvantages—and report to the next Congress.

**Orders for Ljungström Air-Heaters.**—It is reported that since March 1st the factory manufacturing the Ljungström air heater has received orders for 70 air heaters, representing in value over 1,000,000 kr. A licence for the production of the air-heaters in Finland was sold recently. Orders have also been received from Japan.—*Reuter's Trade Service* (Stockholm).

**Applications for British Trade Marks.**—The following are among the recent applications for British trademarks. Objections to any of the proposed marks may be entered within one month of the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given.

Audioform. No. 438,972. Class 8. Apparatus and instruments for wireless telegraphy and telephony. Pacent Electric Co., 22, Park Place, Manhattan, N.J., U.S.A. (Cruickshank and Fairweather, 65-66, Chancery Lane, London, E.C.) August 22nd, 1923.

Amac. No. 435, 878. Class 8. Wireless telephonic apparatus. Amac, Ltd., Lion Works, Witton, Birmingham. August 29th, 1923.

Cymex. No. 438,791. Class 8. Appliances used as detectors in wireless telegraphy and telephony. Norman Hall, trading as the North-Eastern Instrument Co., Albert House, Durham Road, Low Fell, Gateshead-on-Tyne. August 29th, 1923.

**Local Exhibitions.**—Leeds.—The Leeds Corporation has decided to run a "Health and Municipal Services Exhibition" from November 13th to December 1st, to give the inhabitants an idea of the extent and working of the various departments of municipal work. The project is being well supported by the various committees of the City Council, and the executive duties are being carried out by the Medical Officer of Health, Dr. J. Johnstone Jervis; the manager of the Gasworks, Mr. C. S. Shapley; the manager of the Electricity Department, Mr. C. Nelson Hefford; and the City Treasurer, Mr. James Mitchell. The exhibition is to be held in the Artillery Drill Hall, Fenton Street, which is a very commodious and suitable place. A large proportion of the space will be occupied by the exhibits of the Corporation departments, among which the electricity undertaking will figure prominently, but it is expected that some stands will also be available for letting to electrical manufacturers and others.

Liverpool.—The Liverpool Caterers' Association, in conjunction with the Corporation Electricity Department, is conducting a three-weeks' demonstration of electrical cooking at the premises of one of its member firms, Messrs. Francis and Co., Parker Street. Here complete meals, cooked electrically, are being served to customers. One of the main exhibits is a Westinghouse automatic electric baking oven, through which the bread or food to be cooked is carried by a band driven through gears by a 1/6-h.p. motor. Mr. J. H. Crossley, of the Metropolitan-Vickers Electrical Co., Ltd., who is in charge of the exhibit, has just returned from an investigatory visit to the United States. He told an Electrical Review representative that although in Pittsburgh natural gas can be obtained at the price of 2s. per 1,000 cu. ft., electricity at 2d. per kWh is competing successfully with it for cooking purposes. The Westinghouse baking oven has six 4.2-kW elements. All manner of electric heating and cooking appliances are exhibited by the General Electric Co., Ltd., the Falkirk Iron Co., Ltd., Carron Company, the Premier Electric Co., the Automatic Telephone Co., Ltd., and other electrical firms.

**Electrical Trade in Norway.**—The F.B.I. correspondent at Christiania says that the Norwegian market for electrical goods continues dull, and there is hardly anything to be done in British-made articles as prices are too high. The small amount of business that has been done lately has mostly gone to Norwegian manufacturers, and a few orders have also been placed in Germany.

**Semi-Denationalisation in Saxony.**—A Government Bill is to be introduced in the Diet of Saxony to authorise the transformation of the electricity supply works belonging to the State into share companies. It is proposed that the State shall hold 80 per cent. of the share capital in order to exercise a controlling influence over the works. The reason for the projected transfer lies in the circumstance that the State no longer has at disposal the considerable funds necessary for the extension of the works.

**Book Notices.**—"*Journal* of the Institution of Electrical Engineers," Vol. LXI, No. 321. August, 1923. London: E. and F. N. Spon, Ltd. Price 10s. 6d.—The August issue contains the following papers: "The Drive of Power Station Auxiliaries," by Messrs. L. Breach and H. Midgley; "The Compound Characteristic in Regenerative Braking with D.C. Traction," by Messrs. M. G. Say and H. C. Frampton; "The Application of a Revolving Magnetic Drum to Electric Relays, Siphon Recorders, and Radio Transmitting Keys," by Mr. N. W. McLachlan; and "The Design of Inductances for High-Frequency Circuits," by Prof. C. L. Fortescue.

"Technology Reports of the Tôhoku Imperial University, Sendai, Japan. Vol. III, No. 4. Tokyo and Sendai: Maruzen Co., Ltd.—The whole of this number is occupied by a paper upon "The Manufacture of Plastic Products from Proteid of Soy Bean." The author suggests that the material prepared in the way explained in the paper may have a wide use for many technical purposes, including electrical insulation.

"The Trade, Industries, Productions and Resources, &c., of British South Africa and Adjacent Territories," compiled from official sources by C. W. Francis Harrison. Pp. 416. Woodchester, Glos.: Arthurs Press, Ltd. Price 15s. 6d. post free.

**For Sale.**—North Metropolitan Electric Power Supply Co. has for disposal surplus generating plant at the Willesden and St. Albans power stations. The Air Ministry has for disposal a quantity of electric lighting and power cables and about 100 tons of rolled steel shafting. Belfast Corporation Electricity Department has for sale coal-handling plant. (See our advertisement pages to-day.)

**Trade with British Malaya.**—A brief report upon the external trade of British Malaya, reproduced in the *Board of Trade Journal*, shows that during the half-year ended in June, 1923, a great improvement occurred. Raw metal exports rose in value from £5,251,551 to £6,799,591, and metal manufactures from £410,265 to £452,217. The import figures show a decrease in the amount of imported manufactured metal articles from £2,043,586 to £1,940,333, but raw metal imports rose from £1,602,969 to £2,630,698.

**Lamp Price Reductions.**—A reduction in the price of electric lamps is always a noteworthy event, and we are glad to learn that as from September 1st, the prices of all sizes of gasfilled lamps made by the members of the Electric Lamp Manufacturers' Association for circuits at 100-140 and 200-260 volts have been reduced. These lamps, the most efficient electric lamps in use to-day, are rapidly gaining in popularity—we understand that the trade in gasfilled lamps already represents more than half the total trade in metal-filament lamps—and this is the third occasion since 1920 that their price has been lowered; as the labour market has not cheapened since a reduction was made 12 months ago, the present reduction is entirely due to improved efficiency in manufacturing processes. Gasfilled lamps are fully protected by British patents and, therefore, free from external competition, a fact which renders the reduction in price all the more commendable.

*Apropos* of the above matter the British Thomson-Houston Co., Ltd., intends in a series of "Mazda" lamp advertisements to present a number of interesting facts regarding light. These should prove a great "draw" for the statements are very effective. Who can resist reading on when he is told, for instance, that "some of the stars you actually see in the sky may have ceased to exist 1,000 years ago"?

**Lead Report.**—Messrs. James Forster & Co., under date September 1st, report that: Closing prices yesterday were £24 15s. for August, and £24 17s. 6d. November, against £24 10s. at the end of last week—the price for September yesterday being £25 per ton. The feature of the week has been the premium paid for September as against August shipment lead, a considerable quantity changing hands all the week at 5s. per ton over August price. This is said to be due to America buying back September shipment lead already sold here. Consumers here continue very quiet. They are well supplied at the moment by lead released after the strike, which probably amounted to 12/15,000 tons; and supplies continue to come in freely.

**An Important "English Electric" Contract.**—The contract for the electrification of the Campos do Jordao Railway in Brazil, has been awarded to the English Electric Co., Ltd., by the Government of Sao Paulo. This contract covers the electrification of an existing metre-gauge railway, and includes the supply and erection of about 30 miles of overhead catenary construction on the 1,500-volt, d.c. system, and some 15 miles of 30,000-V, 3-phase transmission line.

The contract also includes the building and equipment of a sub-station as well as motor coaches for passenger and freight service. The 30,000-V, 3-phase, 50-cycle supply will be transformed down to 2,000 V at the sub-station, where a 500-kW synchronous motor-generator set will convert it into direct current at 1,500 V. The passenger coaches are to seat 40 passengers, and the freight coaches, which are of the covered type, are to carry 10 tons. The electrical equipment of each type of motor coach will comprise four self-ventilated traction motors, each wound for 750 V. The motors are connected two in series, and the two pairs operated in series-parallel.

The electrification of this line is of particular interest owing to the fact that one-third of the total route length is level, the remainder being over gradients of which the most severe is 10½ per cent., there being some eight miles of track on which the gradients vary from 6 per cent. to 10½ per cent. In view of this, the motor coaches are to be equipped with four different braking systems, *viz* :— hand, air, rheostatic, and electro-magnetic, of which the last named is intended for use in emergencies only.

**Bauxite Production in Germany.**—The Bauxite Works Co., of Giessen, states that of the four bauxite works in Upper Hessen only one is now producing ore, the others having been compelled to shut down in consequence of unfavourable sale prices under existing conditions. In addition, the Ruhr barrier has cut off various customers from Upper Hessen bauxite.

**Calendar.**—The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.4, has sent us one of its calendars bearing illustrations of various aluminium sections and monthly date slips for a year commencing with the present month.

**Forthcoming Exhibitions.**—The following exhibitions are being organised :—

London.—October 15th to 20th. Motor-Cycle and Cycle Show; November 22nd to December 1st, Motor Exhibition; April 28th to May 9th, 1924, British Industries Fair.

Birmingham.—May 12th to 23rd, 1924, British Industries Fair.

France (*Paris*).—November 30th to December 17th, Physical Science and Radio Exhibition.

Havana.—February 9th to 24th, International Samples Fair.

Uruguay (*Montevideo*).—December, Industries Exhibition.

**New Belgian Companies.**—There has been formed at Brussels (Boulevard de Waterloo, 100) the Société Anonyme Etablissements Réunis Wilson, Sping, Cruyt & Co., with a capital of 430,000 fr., for all operations appertaining to mechanics, electricity, chemistry, and coal and marine engineering; also as consulting engineers.

The Ateliers Belgo-Suisses de Décolletage Automatique de Haute Précision is the style of a company established at Molenbrek St. Jean (124, Rue du Jubilé) with a capital of 1,200,000 fr., for the automatic machining of copper, brass, &c., used in the electrical and wireless industries.

With a capital of 500,000 fr. the Société Liégeoise l'Electrolyse has been embodied at Liége for the working of the Marino patents for the metal coating of porcelain and other bodies.

## LIGHTING AND POWER NOTES.

**Aberaman.**—New Plant.—New plant for the generating station of the Powell Duffryn Co. is contemplated. The extension is in connection with the general development of the company's undertakings, and the work is expected to be completed during the next twelve months.

**Barton-on-Humber.**—Electricity Charges.—The Electricity Commissioners have granted an Order to the Barton Electricity Co., authorising it to increase the maximum charge for electricity from 10d. to 1s. per kWh, as from September 1st.

**Barrow.**—Failure of Supply.—The electricity supply was cut off for some time on August 31st, owing to lightning striking overhead electric wires.

**Blackburn.**—Failure of Supply.—There was a sudden failure in the electricity supply for nearly an hour on August 31st, and mills, workshops and tramway services were held up.

**Canada.**—Water-power Contracts.—The Canadian General Electric Co., and the Canadian Allis-Chalmers, Ltd., have received orders for two more complete sets at the Cameron Falls, Nipigon River. The turbines are to be provided by the latter company, and the Canadian G.E.C. will supply the 10,600-kVA generators, and three 8,000-kVA, and three 4,800-kVA transformers.

**Continental.**—Luxemburg.—The Société d'Electricité de la Province de Luxemburg "Sodelux" has recently increased its capital to 3,500,000 fr. for the purpose of extending its system of electricity distribution in the Province of Luxemburg, and in particular between Arlon and Florenville to serve the Semois Valley, and between Arlon, Etalle and Neufchateau. The new lines will serve a population of 50,000, which it is expected will absorb a total of 1,000,000 kWh per annum. A contract has been entered into with the local gas undertaking at Arlon for the supply of electricity, which is estimated in the first year to amount to 250,000 kWh. The Sodelux Co. has arranged contracts for a supply of electricity with the Société des Hauts-Fourneaux et Mines de Halenzy, La Société des Hauts-Fourneaux, Fonderies et Mines de Musson, of Athus-Grivegnée, and the Société des Hauts-Fourneaux et Acieries, of Steinfort. The Sodelux Co. has received financial support from the Luxemburg Provincial authorities, which during the establishment of the first lines, advanced a total sum of 1,400,000 fr.

Sweden.—Various local authorities in the South of Sweden have asked the Government to veto the export of electrical energy from Sweden to Denmark, on the alleged ground that the supply is being given at one-half of the price that is charged in Sweden. As a result of these representations, which concern the South Swedish Power Co., it has since been stated, on behalf of the latter, that the transmission to Denmark applies to surplus power for which the company has no use in its home distributing network, and that the imposition of a veto on the export of the surplus would not result in a reduction in the price to South Swedish consumers.

Moravia.—It is reported that good progress is being made with the scheme for supplying the Republic of Moravia with electrical energy generated by means of water power. According to the scheme which has been prepared, the River Dyje is to be regulated from the western part of Znojmo, along the Austrian frontier as far as Freistein, a distance of about 44 miles. Near Vranov a barrage about 160 ft. wide is to be constructed, and a large generating station established, from which electrical energy will be supplied to Southern, Eastern, and Western Moravia, including Brno, the capital.

**Crediton.**—Electricity Supply.—The Urban Council has decided to ascertain whether Exeter Corporation can supply the town with electricity, and, if so, upon what terms.

**Hamilton.**—Electricity Charges.—A petition at the Dean of Guild Court, on August 30th, raised the question as to whether the charges for electricity supply in Hamilton were too high. Messrs. Archibald Baird & Son, Ltd., Clyde Steel Works, Peacock Cross, sought authority to erect generating plant for their own use. Mr. H. Baird, a member of the firm, addressing the Court, said they paid as much as 4d. per kWh. The cost varied according to the number of kWh used, and the average over a recent month was 1.7d. per kWh. His firm estimated that it could generate its own electricity at a little over .6d. per kWh. It was this consideration that had compelled the firm to propose this scheme. The plans were passed.

**Haywards Heath.**—Inauguration of Supply.—The electricity undertaking of the Haywards Heath and District Electric Supply Co., Ltd., was formally inaugurated on August 23rd.

**Kettering.**—Amendment of Special Order.—The Urban District Council has applied to the Electricity Commissioners for the amendment of a Special Order already applied for, so as to include the parishes of Glendon and Barford.

**Leek.**—Extension of Supply.—In connection with the proposed extension of the electricity undertaking, for which a loan has been applied for, the Electricity Commissioners have suggested that the Urban District Council should obtain a partial supply of electricity in bulk from Stoke-on-Trent Corporation. The Council has received the Corporation's terms for a bulk supply, and is of opinion that the time is not opportune for such an arrangement, and has requested the Commissioners to receive a deputation in order that its views may be laid before them.

**Letchworth.**—Special Order.—The First Garden City, Ltd., has applied to the Electricity Commissioners for a Special Order, authorising it to supply electricity in the urban districts of Letchworth and Baldock, and the parishes of Willian and Radwell.

**Linlithgow.**—Electricity Supply.—A canvass of the residents having proved satisfactory, the Town Council is approaching the Scottish Central Electric Power Co. for a supply of electricity.

**Littlehampton.**—Street Lighting.—The Urban District Council has accepted the tender of the Electricity Co. for public lighting for 10 years at £841 10s.

**Maidstone.**—Special Order.—The Town Council is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity in the parishes of Loose, Linton, East and West Farleigh, Thurnham, Bearsted, Barming, Teston, Wateringbury, East and West Malling, Boxley, Aylesford, Boughton Monchelsea, and Hollingbourne.

**Manchester.**—BARTON POWER STATION.—The new power station at Barton is to be formally opened by the Earl of Derby on October 11th.

**Moreton (Cheshire).**—ELECTRICITY SUPPLY.—The Parish Council is approaching the Wirral Rural District Council for sanction to communicate with the Birkenhead and Wallasey Corporations with a view to obtaining a supply of electricity. The Birkenhead Electricity Committee has already considered the matter, and, subject to the approval of the Wirral Council, is prepared to apply to the Electricity Commissioners with a view to supplying Moreton.

**Northern Ireland.**—HYDRO-ELECTRIC SCHEME.—Despite the many reports to the contrary, the Bann scheme for North-East Ulster has not been abandoned, and the Bill will come in due course before the Northern Ireland Parliament.

**Peterborough.**—INAUGURATION OF EXTENSIONS.—The extensions of the electricity works were to be formally opened on September 6th by Sir James Stevenson, Bart. The total cost of the scheme was nearly £250,000, and included changing over from d.c. to a.c.

**South Africa.**—SALISBURY (RHODESIA).—The *S.A. Mining and Engineering Journal* states that the Salisbury municipal electricity works is to be provided with two gas-engine generating sets, consisting of Browett-Lindley four-cylinder, four-stroke vertical engines direct coupled to 300-kW generators made by the Electric Construction Co., Ltd. There will also be four 300-h.p. gas producers made by the Dowson & Mason Gas Plant Co., Ltd., of Manchester. The sets are to run at 200 r.p.m., the alternators giving a three-phase, 50-cycle output at 2,000 V.

**South Shields.**—YEAR'S WORKING.—The annual report of Mr. James Edgar, electrical engineer for the borough, shows that the electricity undertaking has just concluded a good year. The lighting users are promised a reduction in the charges from 6d. to 5d. per unit, and other consumers are promised concessions. Industrial troubles had the effect of keeping down the energy used for power purposes to almost the same as the preceding year. The Committee's decision to reduce the prices for energy all round which took effect from October, 1922, resulted in a greatly increased number of consumers. The revenue for the year amounted to £86,139, as compared with £84,756 in the previous year. This increase was entirely due to the increase of the current sold for lighting purposes, the total for the year showing an increase of 12 per cent. The working expenses for the year amounted to £41,944, as compared with £41,999 for the previous year. The gross surplus thus amounted to £44,195, as against £43,757, the interest and sinking fund charges for the year totalled to £23,950, an increase of £1,390. After meeting all working expenses, interest and sinking fund charges, wages of staff engaged on capital work, &c., there was left the sum of £15,090.

PRICE REDUCTIONS. — The Electricity Committee has adopted a reduced scale of charges for electricity as follows:—Lighting. Maximum demand system: The existing rate of 7d. per kWh for the first 182 kWh per quarter per kW of maximum demand, and 1½d. per kWh beyond, to be reduced to 7d. per kWh for the first 91 kWh per quarter; next 91 kWh, 5d. per kWh, and all energy beyond this amount, 1½d. per kWh. The alternative tariff charges for the first 10 kWh per £1 of annual rateable value 6d. per kWh, and for all energy above 10 kWh, 1d. per kWh. The Committee also proposes to let out cooking appliances on hire.

**United States.**—LARGE WATER-POWER PROJECT.—The *Electrical World* reports that Hugh L. Cooper & Co. have acquired an option on the rights of the Dixie Power Co. for the exploitation of the White River, Arkansas.

It is proposed to construct a special arch-type concrete dam 225 ft. in height, its base being about 1,000 ft. in length and 1,800 ft. at the crest, establishing an artificial lake nearly 100 miles long covering more than 50,000 acres. The White River project will develop about 160,000 primary electrical horse-power. The plans call for a high-pressure transmission line to St. Louis, 240 miles from the project. The total cost will be in the neighbourhood of from $25,000,000 to $30,000,000. After power requirements in Arkansas and Missouri have been taken care of, the rest of the power developed will probably be transmitted to St. Louis over the line mentioned, to be used by the Missouri subsidiaries of the North American Company.

HYDRO-ELECTRIC DEVELOPMENT.—The Federal Power Commission has granted a preliminary permit to the Louisville Hydro-Electric Co. for the erection of a power station at the falls of the Ohio River to develop 75,000 secondary h.p. The Public Service Co. of Colorado is to erect a steam turbine generating station at Valmont, Colo., with a capacity of 200,000 kW. A permit has been issued to the Electric Metals Co., of San Francisco, for the construction of a dam at Ishi Pishi Falls in Siskiyou County, California, which will create a lake 19 miles long, at the base of which a hydro-electric station with a capacity of 110,000 h.p. will be erected. —*Reuter's Trade Service* (New York).

**Welshpool.**—ELECTRICITY SUPPLY.—The Gas Co. is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity in the district.

**Weymouth.**—YEAR'S WORKING.—The accounts of the Weymouth and Melcombe Regis electricity undertaking (engineer: Mr. G. Nicolson) for the year ended March 31st last, record a total income of £27,665, as compared with £29,467 in the previous year. The working expenses totalled £17,325, as against £22,810, leaving a gross surplus of £10,340 (£6,657). After debiting loan interest, &c., and an amount of £663 for meters, there remained a net profit of £4,631. In the preceding period there was a profit of £1,949. Only £4,123 was spent on capital account during the year—for mains and meters. The sales of energy increased from 1,173,056 to 1,311,702 kWh. The maximum load rose from 631 to 713 kW.

**Whitstable.**—ELECTRICITY CHARGES.—With reference to the application of the Whitstable Electric Co., Ltd., for an Order to authorise the continuance of the charges of 9d. per kWh for lighting and 4½d. per power, the Urban Council has decided to protest and to ask the Ministry of Transport to grant the increase only until the end of 1924, the charges then to come up for revision. The Council is of the opinion that, whilst at the present time the charges are reasonable, they should not continue indefinitely.

## TRAMWAY AND RAILWAY NOTES.

**Aberdeen.**—YEAR'S WORKING.—The report of the general manager of the city tramways (Mr. W. Forbes) for the year ended May 31st last states that the total income of the tramways was £184,868, as compared with £184,618 in the previous year. The working expenditure amounted to £133,614, as against £131,250, leaving a gross profit of £51,254, as compared with £53,368 in 1921-22. The capital charges were considerably higher, and the net profit was thus reduced from £15,089 to £8,663. A balance of £1,257 was carried to the renewal and reserve accounts from the motor-omnibus accounts. The capital expenditure during the year amounted to £31,851, permanent-way reconstruction costing £22,640, and motor-omnibuses, £4,187. The tramway car-mileage rose from 2,252,889 to 2,399,742, and the number of passengers carried from 41,087,388 to 41,162,504.

FARES REVISION.—The Tramways Committee has decided to reduce the fares on the tramways, and to raise the age limit for half fares from 12 to 14 years.

**Australia.**—SYDNEY (N.S.W.).—As a means of supplementing the work of dealing with the city traffic to be undertaken by the new city railway, the Railway Commissioners have before them a scheme which provides for underground tramways from Circular Quay to the eastern and western suburbs. The underground tramways are recommended not so much as a means of satisfactorily relieving the dense passenger traffic, but rather as a means of facilitating the vehicular and pedestrian traffic by removing tramcars from the streets. It is claimed that the cost of the underground tramways can be justified for this latter purpose, but not for the former, as the volume of traffic which could be taken by two car units is small compared with what could be taken by electric railway trains.—*Industrial Australian and Mining Standard.*

**Continental.**—FRANCE.—The improvement of transportation in the Savoy by means of a network of narrow-gauge (0.60 metre) tramways was estimated, before the war, to cost 80,000,000 fr. for some 200 km., but for reasons of finance has not hitherto been realised. The only district now served by tramways is that of Chambery, where a 23-km. network, 0.60 gauge, exists, worked by steam. A scheme to electrify this portion is now being prepared at an estimated cost of 2,860,000 fr., of which the rolling stock accounts for 540,000 fr. Three or four years would be required to electrify the whole of the Savoy lines.

The Compagnie des Omnibus et Tramways of Lyons intends to electrify the Lyons to Saint Priest and the Lyons to Neuville and Trevoux tramway lines, the latter section being widened to metre gauge. The line from Lyons to Bellecour and Trois Renards is to be extended and electrified to Charbonnières.

A scheme for the construction of an electric railway in two sections in the department of Puy-de-Dôme is now in hand. The first section will run from Laqueille to Saint Anthème; the second section, for which surveys are now in hand, will link the last-mentioned town and Montbrison, and will be 28 km. in length. The estimated cost of construction is 300,000 fr. per km.

**Huddersfield.**—TRACK RENEWALS.—In order to provide work for the unemployed during the winter months, the Corporation proposes to reconstruct certain portions of the tramway track and to double the line in Wakefield Road at an estimated cost of £22,440.

# AN ELECTRICALLY-DRIVEN ICE-MAKING PLANT.

## The Poynernook (Aberdeen) Installation.

The ammonia ice-producing plant recently installed at the Poynernook (Aberdeen) premises of the Aberdeen Steam Trawling & Fishing Co., Ltd., presents many attractive points to those connected with this branch of engineering. The main interest centres around the fact that the compressors, brine-circulating pumps, ammonia and condenser-cooling water pumps, the overhead travelling crane, and the ram device which pushes the rows of cans from the front to the rear of the tank during the freezing process, are all electrically driven, being coupled direct to a separate motor in each instance. This is the first plant in the north of Scotland to be so equipped; its machinery, moreover, is the largest and fastest of the kind so far erected in Great Britain.

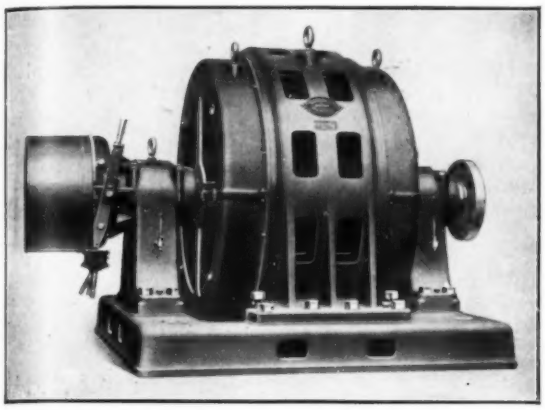

Fig. 1.—Brush 250-b.h.p. Induction Motor.

The complete installation was carried out according to the specifications and under the personal supervision of Mr. D. MacBride, consulting engineer, of Glasgow, to whom we are indebted for the following particulars:—

The ice-producing plant actually consists of two separate and independent units, each capable of producing 75 tons of ice per diem. The compressors are of the quick-revolution single-acting type, each machine having four cylinders, the compressor heads being water jacketed. All valves are of the light ring-plate pattern, with safety devices to prevent the moving parts from falling into the cylinder, and together with their seats may be easily removed without disturbing any moving parts of pipe-work. The gland is of the rotary type and, owing to its being under low pressure and also subjected to a permanent positive oil-pressure (due to its being incorporated in the forced-lubrication system), is practically immune from any possibility of trouble. Scraper rings in the skirt of the trunk piston, combined with an ingenious design of oil separator, entirely prevent the passage of oil into the ammonia system. The compressors are fitted with a bye-pass arrangement, whereby they may be started up to all intents and purposes unloaded.

Each of the two machines is direct-coupled to a Brush induction motor of the pedestal type, figs. 1 and 2, which have pedestal bearings lubricated by means of oil rings, and totally enclosed slip-rings. A short-circuiting and brush-lifting device is also fitted that is particularly simple and positive in action, only one movement being required for short-circuiting and brush-lifting; the arrangement is such that it is impossible to open the rotor circuit until the brushes are on the rings. Each motor is controlled by means of an oil circuit-breaker and a Brush liquid rotor starter, capable of starting the motor once every four hours against two-thirds of the full load torque. Running at 230 r.p.m. on a 3-phase, 50-cycle, 400-volt supply, each motor develops a normal output of 250 b.h.p. It was found necessary to adopt a special form of winding for these motors, for, on account of the low running speed, it was not easy to reconcile the requirements of a good power-factor and a high pull-out torque. Each motor is capable of withstanding 25 per cent. overload for two hours without stalling, injurious heating, or mechanical damage. By the installation of these motors instead of the usual steam engine a great economy of space has been effected; further, the flywheels of the compressors were greatly reduced in size owing to the large amount of kinetic energy developed by the massive rotors of the induction motors. The whole of the electrical equipment in connection with the compressors was supplied by the Brush Electrical Engineering Co., Ltd., of Loughborough.

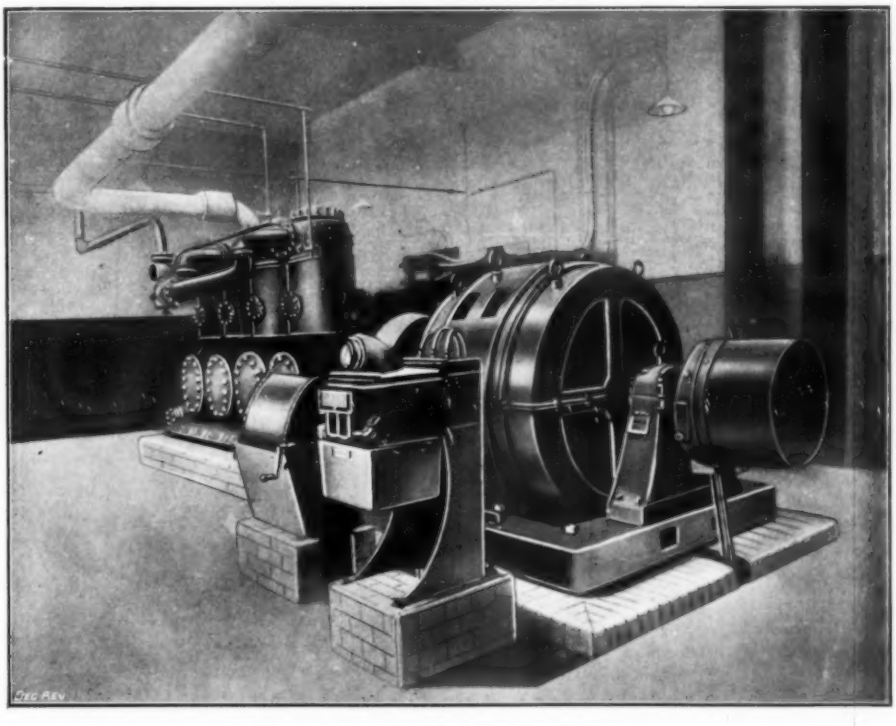

Fig. 2.—Motor-driven Compressor.

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The compressors work in conjunction with "Block" flooded ammonia condensers, a good proportion of the credit for the high output and economical power consumption of the plant being due to them. In order to save space in the ice-making room and thus allow for the largest possible number of ice cans to be installed, the usual practice of cooling coils being submerged in a compartment of the ice-tank was not employed, the brine being cooled instead by means of a modern shell-type brine cooler placed underneath the ice tank appropriate to each unit of the plant. This arrangement has proved remarkably successful, the difference between the temperature of the expanding ammonia and the cold brine not exceeding from 7° to 8° F. The saving of space thus obtained permits of the production of 75 tons of ice in the space formerly needed for only 25 tons. The insulation of the freezing tanks is worthy of notice, consisting, as it does, of pressed cork slabs, finished off with a special waterproof cement. It is a great advance upon the old system of double wooden walls packed with granulated cork or silicate cotton. The water to be frozen is run through automatic measuring devices into cans fixed in steel racks, thus obviating the necessity of weighing the finished product. As a rack-full of cans of ice is lifted by the electric crane and deposited for a short period in the thawing tank, prior to tilting and discharging their contents, an ingenious electric ram is brought into operation, which pushes all the rows of cans forward in the tank so as to leave space into which to lower a fresh rack for freezing; this process continues so long as the plant is running (figs. 3 and 4).

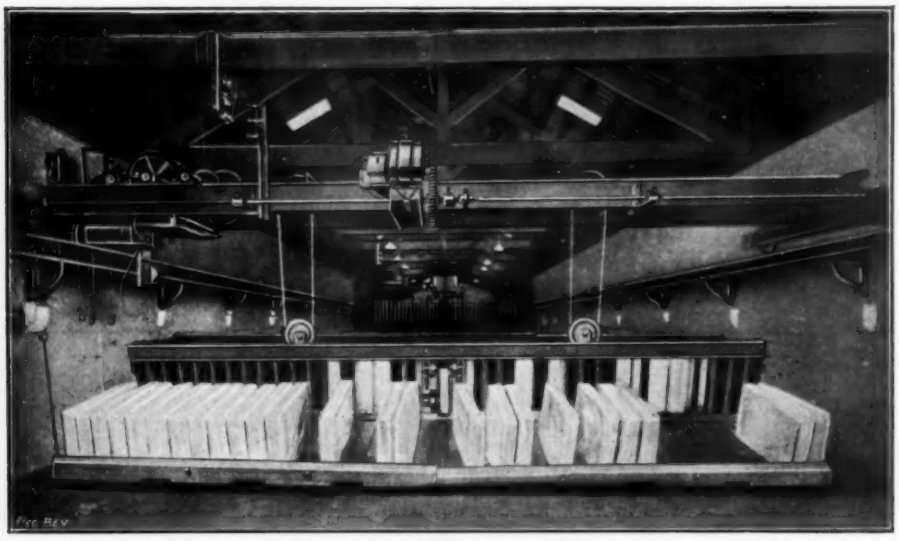

FIG. 3.—TILTING THE ICE OUT OF THE CANS.

That this system of direct electrical drive, with its conservation of power, which would otherwise be lost in shafts, belts, &c., together with the comparative cheapness of electricity, is appreciably economical in running costs is amply demonstrated by comparison with a steam-driven plant in the same district. Even under such favourable conditions as a steam consumption of 12 lb. per i.h.p.-hour, a boiler evaporation of 8 to 1, with coal costing 32s. per ton, the economy of electrically driving the main compressors and all auxiliaries is most marked.

So far as reliability is concerned, those in charge of the plant have not experienced the slightest trouble with any part of the machinery since its installation.

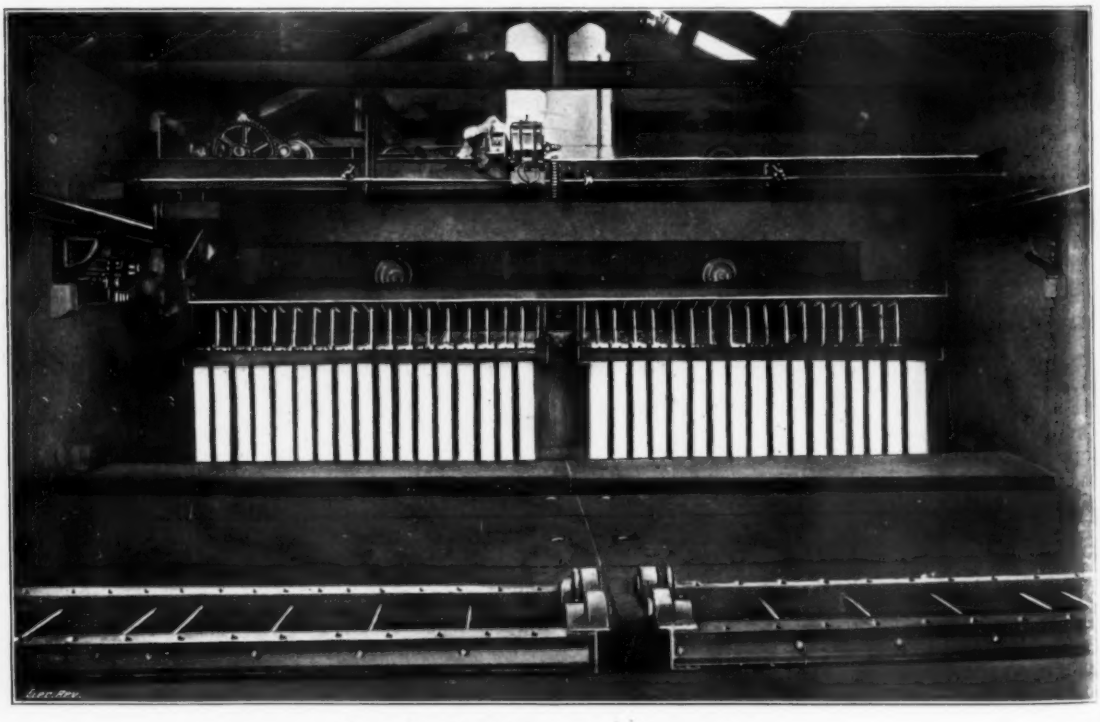

FIG. 4.—ICE CANS LIFTED OUT OF THAWING TANK.

# A GREAT JAPANESE POWER SYSTEM.

## The Ohi Hydro-Electric Plant.

By ERNEST V. PANNELL.

One of the most remarkable cities in the world is Osaka, in Japan, which unites history and tradition with modern industrial development, finance, and economic prestige. Whilst Tokio is the capital of the Empire, Osaka will always be more representative of the new Japan, of factory, exchange, and shipping-dock. No visitor can fail to appreciate the significant part in the life of this city of nearly two million souls within which not only is virtually every room in every house electrically lighted, but the use of illuminated signs is apparently more widely spread than in most of the cities of the Western world. A network of electric car lines covers every part of the city and links up with high-speed electric lines of heavier types operating to Kobe, Kyoto, Nara, and other points at a wide radius.

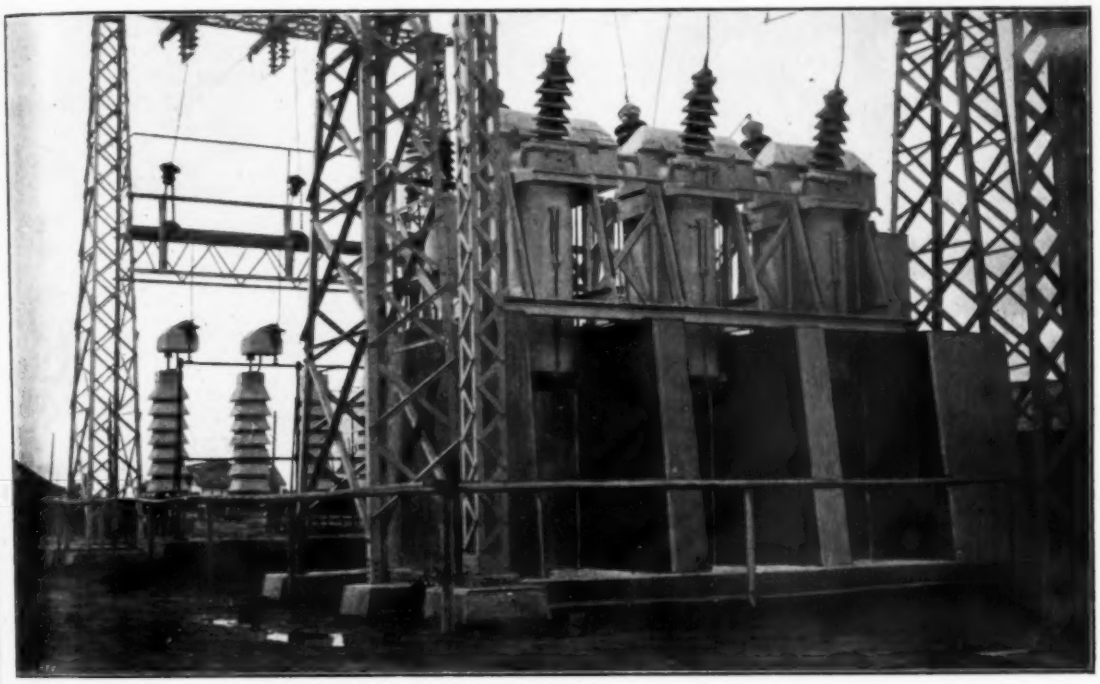

Fig. 1.—Bank of 150-kV Oil Switches at Osaka Sub-station, showing Lead-Oxide Lightning Arresters in Rear.

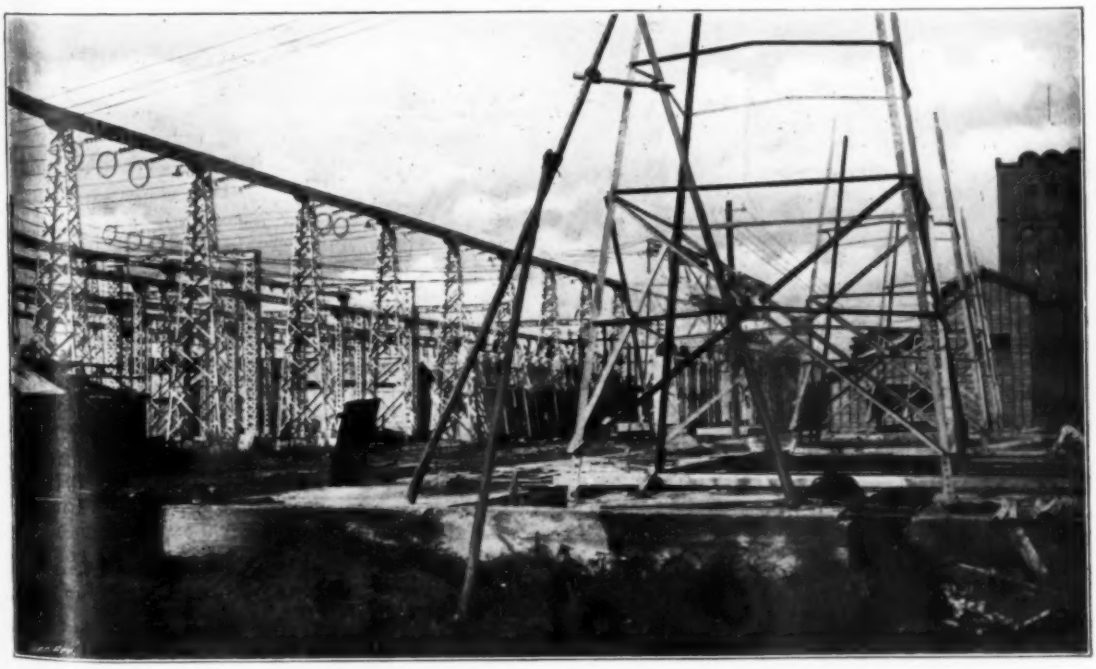

Fig. 2.—Open-air Sub-station at Osaka.

It should be admitted that Japan was quite early in

the field of electric light and power development, for nearly thirty-five years ago the first electric light was produced in Osaka, and the first Japanese electric railway was initiated six years later in Kyoto. Hydro-

Fig. 3.—Part of 150-mile Transmission Line approaching Furukawabashi.

electric power was introduced in 1891 and high-pressure transmission in 1898. It will not be surprising to learn, therefore, that modern Japanese development in electrical engineering is, at least, equally as advanced as anywhere in the world. At the present time it is estimated that out of seven million available water horsepower (based on minimum flow), one and a half millions is being harnessed to produce electricity.

Probably the most extensive power corporation in the Island Empire is the Daido Electric Power Co., which supplies the city of Osaka, together with Nagoya, Yokkaichi, Kyoto, and, through its affiliations, Toyama, Kanazawa, and other cities on the remote northern shore of Hondo, the central island of Japan. The Daido Co. represents the amalgamation of a number of power interests in contiguous territory under the capable financial direction of Mr. M. Fukuzawa. The business of the company is to generate electricity at the various falls of the Kiso River and elsewhere, and to sell the power mainly in the Osaka district. The capital of the company as at present subscribed is approximately £4,500,000 in preferred and ordinary shares, plus £3,000,000 in debentures, paying 7 per cent. At the time of writing, the total connected load on the system approaches 200,000 kVA, and construction is in progress to increase this amount by 50 per cent.

The bulk of the power is generated on the Kisogawa, one of the "four great rivers" of Japan, there being no fewer than twelve installations of plant operating, or being constructed at different points along the valley, all having an average head of 150 ft. and having outputs rated at from 4,000 to 45,000 kW. (It should be remarked that, by virtue of the code of the Japanese Federal Department of Communications, the plant capacity is 25 per cent. greater than the rated capacity of the stations, this margin representing a reserve.) This disposition of a series of stations along the same river provides for development at a reasonably low cost, and, although the extreme sets of plant are 75 miles apart, it can truly be said that the tail-race of one station provides the head water of the next. Midway in the chain of stations lies the Ohi power house, with a capacity of 44,000 kVA, and now just being completed. At this point the effective head is 140 ft., provided by a dam 180 ft. high, built of cyclopean masonry, and a pressure tunnel 3,000 ft. long, yielding a discharge of 4,500 second-feet.

Fig. 4.—Laying 11,000-V Cable near Osaka.

Fig. 1.—Penang Hill Railway (see p. 361).

The Ohi equipment comprises four Allis Chalmers-General Electric sets providing 56,000 kVA at an 80 per cent. power factor, 66,000 volts, 3 phase, 60 cycles. Two banks of Westinghouse transformers are connected to the 6,600-volt busbars to step the pressure up to 154,000 volts; they are connected delta to star with an open neutral, whilst an extra bank is in reserve. This great proportion of spare plant is characteristic of Japanese construction, and seems to indicate too extreme conservatism. It will be noticed, however, that the high-pressure neutral point is unearthed, and damage to apparatus cannot fail to be more prevalent for this reason. Japanese practice leans towards undue protection of telephone and telegraph circuits at the expense of power lines, and for this reason the neutral point of the "Y"-connected high-pressure circuits may not be connected directly to earth. There is a tendency among the engineers of the present 154-kV lines to insert a Peterson reactance coil in the earth connection, and it is believed that this device will drain the system in the event of a bad short circuit without giving rise to interference with signal lines; at any rate, the reactance

soil will be better than an insulated neutral point, though not so satisfactory as a solid earth connection.

All the power stations on the Kiso River are tied together by means of a 77-kV line, which also taps other sources of power. In the more recent installations of plant, the transformers are wound for 154 kV, and a double-circuit tower line at this voltage connects Suhara (the main switching station for the Kiso sets of plant) with Osaka, a hundred and fifty miles away. This is one of the most substantial and up-to-date high-pressure lines recently constructed; the towers, fig. 3, are 80 ft. high, weigh about 800 lb. each, and are spaced at an average of 800 ft. apart. Ten unit suspension insulators are used as standard, and each string is suspended from a link to increase the mechanical flexibility and to permit the ultimate increase of voltage by substituting two or three more units. The bulk of the conductor material is 37 strand copper of about 0.40 sq. in. section, but in the mountains, where the critical corona voltage is lower, there is a tendency to use a larger conductor by way of compensation. For this reason quite an appreciable mileage of steel-cored aluminium wire is now being strung on the line. Some sections of the line cross exceedingly rough country, and the use of such reinforced cable makes it possible to string a longer span and so reduce the construction cost.

Few localities offer more difficult constructional problems than the average Japanese terrain. The mountains are, on the one hand, high and steep and intersected with deep gorges; on the other hand, the lowlands are given over to rice cultivation, and are almost permanently flooded. Rivers are extremely wide and swift and have unsound banks, while, added to these factors, is the constantly-recurring earthquake which yields sensible tremors at least twice a month. Line construction is therefore costly; concrete anchors are almost universally employed; towers must be built up in sections instead of being hoisted ready assembled; wire can be pulled in but slowly, as it is generally submerged in the swampy ground. For these reasons great credit is due to the Japanese engineers for keeping the construction cost as low as it is.

Near Osaka the 150-mile line terminates in an open-air sub-station, which is one of the greatest in the world, fig. 2; its present capacity is about 140,000 kVA, but ultimately it will be able to handle 500,000 kVA. There is a 140-kV ring busbar arranged to connect with up to 20 incoming circuits, each with its own switches, transformers, and protective devices. The transformers are wound for 154 kV, but have a tertiary winding for 50 kV for local transmission to the distributing companies' sub-stations, as well as a secondary winding for 11-kV delta connection. There are at present six banks of transformers, each bank approximating 28,000 kVA; six synchronous condensers are also provided, each of 15,000 kVA.

Although most of the outgoing lines from this station are at 50 kV, there is also an outgoing 11-kV tie line, which takes the shape of a three-core paper-lead cable, steel-tape armoured and laid in concrete troughs, fig. 4. This high-voltage cable is one of the few items in the construction work which is entirely the product of the Orient. It was manufactured in a Japanese mill, and is entirely representative of the best cable-makers' practice; similar three-cored cables to withstand 22 kV are manufactured in the same factory.

The Daido Electric Power Co., by wise consolidation, has grown out of a series of small power companies to an organisation of boundless possibilities, because within its territory some 300 miles of main-line railway is operated. All this mileage is fast being converted to electrical operation, and, when completed, a constant and assured load up to 200,000 kW will be available for the power company.

[Since this article was prepared for publication, describing some of the achievements of Japanese engineers, their country has suffered a disaster of unprecedented magnitude. Our readers will share our profound sympathy with our former Allies in their misfortune.—Eds. Elec. Rev.]

## THE PENANG MUNICIPAL COMMISSION.

### Electricity Supply and Tramway Department.

We have received from Mr. W. J. Williams, M.I.E.E., M.Am.I.E.E., a photograph, which we have reproduced on p. 360, fig. 1, of the Penang Hill Railway which is now nearing completion, and is expected to be opened to traffic next month.

Mr. Williams is the engineer-in-chief and general manager of the Electricity Supply and Tramway Department of the Penang Municipal Commission, and claims that since he took up his appointment in January, 1921, the number of kWh sold in Penang has been doubled, and that the load factor of the undertaking has been raised from 21.5 to 45 per cent. He has at present under construction a large electricity generating station at Prai, on the mainland, and Penang will ultimately be connected to the mainland by means of about 4½ miles of submarine cable operating at a pressure of 11,000 volts.

The annual report on the undertaking shows that 1922 was a very anxious year for all trading concerns in the country, but the department was able to contribute $20,000 to the municipal funds after paying all overhead charges. Whilst the lighting rate was reduced by 12.5 per cent. to 35 cents per kWh from January, 1923, the cost of electricity for power purposes was lowered to a figure that has never been reached before, and Penang to-day has the distinction of supplying the cheapest electricity for power in Malaya.

Some interest has recently been shown in domestic electric cooking, and several electric ranges have been installed. There are distinct signs of a more general adoption of electricity for all kinds of domestic and industrial purposes, and the electrical showroom has proved its usefulness.

Although the population has increased by 2,647 since 1921, the kWh per head per annum have increased from 13.33 to 16.77.

During the year under review $409,442.16 was expended on new work, of which the provision of additional plant and equipment for extension of overhead and underground mains and feeders forms a large proportion. The total revenue over expenditure leaves a net profit of $15,112.66, the revenue being $631,231.16; the expenditure was $344,843.85, or 12.10 cents per kWh sold, a decrease of 7.80 cents as compared with 1921.

The energy sold increased by 24.4 per cent. to 2,832,000 kWh, and there was a net increase of 258 consumers with an equivalent added load of 272.8 kW, which brings the total number of consumers to 3,800, representing 2,660.3 kW.

The annual report on the tramway undertaking shows a deficit of $34,876.64. This department is suffering from the effects of seventeen years of hard wear and tear, and maintenance charges are excessively high on this account. Motor 'buses were adopted in order to discontinue the town traffic by rail cars, because the permanent way had reached a stage when it was dangerous to continue running on it. Electric railless cars would be very much more economical, and it is proposed in the near future to convert the petrol 'buses into railless cars by the substitution of an electric motor for the engine, taking a supply from overhead trolley wires.

# TELEGRAPH & TELEPHONE NOTES.

**Australia.**—Long-range Communication.—At the annual meeting of the Amalgamated Wireless Co., Mr. Allard, the chairman, announced that definite steps had been put forward for the inauguration of direct wireless communication between Australia, England, and other countries. A tender was accepted from the Marconi Co. for the erection of a high-power station in Australia at a cost of £487,000 and for corresponding stations in Great Britain and Canada. Mr. Fisk said that the transmitting equipment would comprise a valve station of 1,000 kilowatts, aerials, and twenty lattice steel masts 800 ft. high. The five sets of receiving equipment would be capable of receiving simultaneously from five different countries and five stations in one country. The service would be operated from the heart of the city without relays, with incoming and outgoing speeds of 120 words a minute. A corresponding station of the same type would be operated from the General Post Office, London. Feeder stations in other State capitals would communicate direct with the main station. Mr. Fisk outlined an extended coastal radio service of greater range than the inland service providing telegraph and telephone services to isolated places, a broadcasting service, a marine service, and police system. In Sydney a company is already organising the comprehensive broadcasting of news and entertainments, and others are following.—*Daily Telegraph.*

**Bulgaria.**—New Radio Stations.—It is stated that the Bulgarian Ministry of Railways, Posts, and Telegraphs has under consideration a scheme for setting up twelve wireless telegraphic stations in the principal towns of the country.—*The Times.*

**New Zealand.**—Telephone Rates.—On October 1st there will be brought into operation a new scale of telephone charges on the flat-rate principle, but lower than were originally proposed. The Prime Minister, Mr. Massey, stated recently that for the last year the Post and Telegraph Department produced a surplus of £592,487, the largest in its history, though reduced rates were in operation for the last two months.—*Industrial Australian and Mining Standard.*

**Submarine Cables.**—Laying Operations.—Reuter's agency is informed that the Commercial Cable Co., which has large cable schemes on hand, laid the American end of its new Atlantic cable on August 25th at Far Rockaway, Long Island, and the British end on September 1st at Weston-super-Mare. Three British cable ships, the *John W. Mackay*, the *Colonia*, and the *Faraday*, are engaged on the work, and the cable is expected to be in actual operation by September 15th, establishing the sixth complete cable circuit between the United States and Europe for this company. In the construction of this new cable more than 4,000,000 lb. of copper, 1,800,000 lb. of gutta percha, and some 80,000 miles of iron and steel wire of various sizes were used. The cable will be capable of transmitting 1,200 letters per minute, 600 in each direction simultaneously, a capacity nearly twice that of any other long cable now in operation anywhere. This is the first cable to be laid between the United States and Europe since 1910. The conductor of the main sections will weigh 1,100 lb. per nautical mile, which is 50 per cent. more than the heaviest hitherto used. The entire cable has been manufactured in England and the deep-sea portion will not be much more than 1¼ in. in diameter, and will lie from two to three miles below the surface of the sea.

On August 20th the cable ship *Restorer* was to have left Vancouver for San Francisco, where she was to pick up cable from England, and, carrying it to Midway Island, begin laying the shore connections for the Pacific Cable Board's second cable.

## RADIO-TELEGRAPHY AND TELEPHONY.

**France.**—Broadcasting Rights.—A movement has been begun, on the initiative of Me. Homburg, a Paris barrister, for the promotion of an international committee to protect authors and artists whose interests are affected by broadcasting entertainments. It is contended that new laws are necessary to safeguard artistic and literary rights. As to authors' royalties, it is held that the broadcasting companies rather than the public should pay, and a more binding financial contract than now exists is suggested between the companies and the proprietors of places of public entertainment.—*The Times.*

**Radio Broadcasting.**—Relay Transmission.—Important new developments have just been completed in connection with the London and Birmingham broadcasting stations. They are part of a system which will soon be extended to all the stations of the Broadcasting Co., and briefly, the idea is to make London a kind of broadcasting exchange, so that events of outstanding interest at any station can be radiated from one, or more, or all of the other stations simultaneously. The first step so far as Birmingham and London are concerned was the conclusion of an agreement with the Post Office which ensures to the Broadcasting Co. the use for the whole of every evening of the week of one of the trunk telephone lines between the two cities. By means of this the two transmitting studios will be connected, and similar arrangements are to be made for all the stations, each being connected to London. The apparatus at Birmingham has been installed by Post Office engineers, under the supervision of Mr. J. A. Cooper, the senior maintenance engineer at the station. It provides for the speedy changing over from Birmingham's transmission to that of London, and additional switches permit the radiation of music from a local picture theatre, near the orchestra of which a microphone panel has been permanently installed. The switching arrangements are so simple that within two seconds the transmission from the station studio can be cut off and that of London, or of the picture theatre, can be substituted. Eventually, when all the stations have been connected to London, the operator at any one of them will have at his command the whole range of programmes transmitted from the company's stations. He may choose one that is desired, switch in the trunk-line on which it is conveyed to his own amplifying panels, and re-radiate it from the aerial at its original strength. The amplifier in use at Birmingham is remote from the transmitting gear, and is contained in the modulating room of the studio. Use is made of three valves in cascade, into which the "speech current" from the land-line is passed. The valves are given a plate voltage of 130, and the current flowing in the plate or "output" circuit varies from .5 milliamp. in the first two, to 6 milliamps. in the third, so that the original current is amplified greatly before it passes to the transmitting gear. A separate switch brings into use independent receiving sets installed in the studio offices, so that the quality of the transmission can be judged and the right degree of amplification ensured. The use of many miles of land-line introduces a slight amount of distortion into the transmission, and to overcome it the company's engineers are experimenting with filter circuits.

**Russia.**—French Radio Contract.—A wireless message from Moscow, dated August 28th, contains the brief announcement that the People's Commissioners have confirmed for a period of five years a contract concluded between the Soviet Electrical Trust and the General Radio-Telegraph Co., of Paris, which supplies apparatus for the erection of radio stations in Russia.

# CONTRACTS OPEN AND CLOSED.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

## OPEN.

**Aberdeen.**—September 17th. Electricity Department. Coal-handling plant. (August 31st.)

**Abersychan.**—September 17th. Urban District Council. Carrying out certain electric lighting work within the urban district. (See this issue.)

**Australia.**—Sydney.—October 31st. N.S.W. Government Railways and Tramways Department. Three steam turbine-driven centrifugal boiler feed pumps, air washer, and humidifier. (October 24th.) Rotary-converter sets.*

Victoria, Melbourne.—October 6th. Electricity Commissioners. 22,000-V insulators.*

Adelaide (South Australia).—October 30th. S.A. Harbours Board. Four 7-ton electric travelling coal-unloading cranes. Specifications from the offices of the Board, Victoria Square, Adelaide.—*Industrial Australian and Mining Standard.*

**Belgium.**—September 12th. Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. 1,040 metres of four-conductor armoured cable and 29 terminal boxes.

September 14th. Municipal authorities of Beverloo (Province of Limbourg). Concession for the establishment of a low-pressure electricity distribution system in the town. Particulars for 25 fr.

Antwerp. — October 16th. Direction du Service de L'Outillage du Port. Fifteen 3-ton electric cranes.*

**Bristol.**—September 11th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

**Canada.**—Toronto.—October 9th. Municipal Council. A.c. generator.*

**Chesterfield.**—September 12th. Electricity Department. Electrically-driven induced-draught plant, with starting and regulating gear, dampers, &c. (August 31st.)

**Croydon.**—September 27th. Board of Guardians.—Six months' supplies of electrical appliances. Mr. N. P. Walker, Clerk to the Guardians, Mayday Road, Thornton Heath.

**Dundee.**—Town Council. 200 tons of steel tramway rails, B.S.S. No. 7. Particulars from City Engineer.

**Edinburgh.**—September 10th. Tramways Department. 168 steel tramway poles and scrolls, &c. Forms from the manager.

**France.**—Bourges.—September 13th. Supply of electric material, including insulating material, steel pipes, circuit breakers, glow lamps, wire and cable, &c. Particulars, Ecole de Pyrotechnie et Atelier de Construction, Bourges.

**Hornsey.**—September 10th. Electricity Department. L.p. switchgear. (August 31st.)

**Ilford.**—September 25th. Electricity Department. E.h.p. cable. (August 31st.)

**Leicester.**—Electricity Department. Four water-tube boiler equipments, complete with superheaters, economisers, pipework, &c. (See this issue.)

**London.**—Post Office Stores Department.—September 24th. Supply of Swedish, Norwegian, Finnish, or Baltic red fir and home-ground larch or Scots fir telegraph poles. The Controller, Post Office Stores Department, 17-19, Bedford Street, W.C.2.

Greenwich, S.E.—September 13th. Board of Guardians. Supplying and fixing tubing for wires for electric lighting, Woolwich Road Institution. Mr. A. Roberts, surveyor, 92, London Street.

India Store Department.—September 21st. Lead-sheathed cable. (See this issue.)

Islington.—September 11th. St. Mary's Board of Guardians. Six months' electrical supplies. Mr. A. King, clerk, St. John's Road, Upper Holloway, N.

Westminster, S.W.—September 12th. Board of Guardians. Electric lamps and fittings. Mr. W. J. Leckley, clerk to the Guardians, Princes Row, Buckingham Gate, S.W.

Edmonton, N.—September 10th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk to the Guardians, 77, Bridport Road, Edmonton, N.18.

H.M. Office of Works.—September 21st. Supply of incandescent electric lamps. (See this issue.)

Metropolitan Asylums Board.—October 10th. Electric lighting installation in the old East Cliff House at Princess Mary's Hospital, Margate. (See this issue.)

**Lochgelly (Fife).**—September 17th. Town Council. Electric lighting installation in connection with the housing scheme. Mr. A. D. Haxton, architect, 3, High Street, Leven.*

**Manchester.**—September 11th. Tramways Committee. Steel girder tramway rails, steel tramway poles, span wire brackets, and copper bonds. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

September 29th. Waterworks Committee. Electric motors, with speed-reduction gear, transformer and converting plant, cables, wiring, &c., in connection with the driving of two sets of reciprocating hydraulic pumps. (See this issue.)

**Motherwell and Wishaw.**—Burgh Council. Electric lighting installation (50 houses). Schedules from Town Clerk, Motherwell.

**New Zealand.**—Wellington.—October 31st. Post and Telegraph Department. 30,000 dry cells for telephones.*

**Northern Ireland.**—Belfast.—September 12th. Ministry of Home Affairs (Maintenance Branch). Twelve months' wireless supplies for the police in Northern Ireland. Secretary, Ministry of Home Affairs (Maintenance Branch), Plough Chambers, 5, Cornmarket, Belfast.

**Pontypridd.**—September 12th. Board of Guardians. Three months' supplies of electrical material. Mr. W. Spickett, clerk to the Guardians, Union Offices, Pontypridd.

**Salford.**—September 24th. Electricity Department. Cooling towers, pumping plant, and pipework at Agecroft power station. (See this issue.)

**Stoke-on-Trent.**—September 12th. Electricity Department. Two cooling towers (200,000 gallons each), with cooling ponds and accessories. (August 31st.)

**Uruguay.**—Montevideo.—October 15th. State Electricity Works. L.p. armoured cable, telephone cable, and accessories.*

**Warrington.** — October 1st. Electricity Department. Motor-driven air compressor. (See this issue.)

September 18th. Sanitary Works Committee. Electric vehicle battery-charging plant. (See this issue.)

**Windsor.**—September 24th. Board of Guardians. Electric lighting installation at the Windsor Poor Law Institution. Mr. W. W. Nobbs, 50, Fairhead Gardens, London, N.W.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

## CLOSED.

**Beckenham.**—Urban District Council. Accepted:—
"Utility" current limiters for 12 months.—Electrical Utilities, Ltd.

**Belgium.**—Municipal authorities of Schaerbeek, Brussels: Eight concerns competed for the contract for the supply of 5,000 metres of armoured cable, these comprising two Belgian firms and one each Dutch, French, Swiss, Italian, and British (the British Insulated and Helsby Cables, Ltd.). The lowest offer was that of the Société des Constructions Electriques de Charleroi.

**Blackburn.**—Board of Guardians. Accepted:—
Electrical installation at the Workhouse.—C. T. Briscoe & Sons.

**Bradford.**—The Electricity Committee, on the recommendation of the Sub-Committee, has recommended that the contract for the 20,000-kW turbo-alternator should be placed with a British firm. Forty-three tenders were received from British and Continental manufacturers. The quotations received from the Continent were considerably lower than those received from any British firm, but after capitalising the value of the difference in the guaranteed steam consumptions, this difference was reduced to about £9,000. The Sub-committee eventually recommended that the tenders of the English Electric Co., Ltd., and Messrs. C. A. Parsons and Co., Ltd., should be accepted. Messrs. Parsons & Co., Ltd., will supply the alternator and exciter, and the English Electric Co., Ltd., the new turbine, the design of which will be jointly considered. The approximate value of the contract is £60,000.

**Colchester.**—War Office. Accepted:—
Electric lighting installations at Meeanee and Sobraon Barracks, Colchester.—Truslove & Co.

**Dover.**
Electrical installation at Messrs. Tyler & Son, Ltd.—J. S. Etheridge & Co.

**Dudley.**—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£1,255).—Mr. G. T. Walker.

**Leeds.**—Turbo-alternator Contract.—The Electricity Sub-Committee has decided to recommend a British tender, and the full Committee has supported this finding. The City Council at Wednesday's meeting was to be asked to confirm this recommendation. The British firm whose tender is recommended is the British Thomson-Houston Co., Ltd. It is for the supply and erection of a steam turbine, three-phase alternator, and condensing plant and accessories at £31,470. Nineteen tenders were received, and of these four were from firms in Switzerland and the remainder from British firms.

According to the *Yorkshire Observer*, the Electricity Committee, in deciding to recommend the tender of the British Thomson-Houston Co., Ltd., has not been solely influenced by the desire to prevent the contract from going abroad; it is of opinion that the plant which it has recommended will give better value for the money than some of the lower-priced tenders.

**Maidstone.**—Town Council. Accepted:—
Transformer.—Johnson & Phillips, Ltd.
Cable (£190).—Craigpark Cable Co.
Castings, rails, fishplates, &c., for Cannon tramway terminus (£171).—Hadfields, Ltd.

**Salford.**—Health Committee.
Installation of electric lighting at Ladywell Sanatorium.—Maitland & Co.

Tramways Committee.
Ten outside roof covers, seats, &c., for small cars (£3,050).—English Electric Co., Ltd.

Town Hall and Markets Committee.
Alterations and additions to the electric lighting installation in the assembly room at the Town Hall.—W. Anderton & Co., Ltd.

Electricity Committee.
Coal and ash-handling plant at the Agecroft power station (£9,155).—R. Dempster & Sons, Ltd.
572 yd. l.p. cable (£277).—W. T. Glover & Co., Ltd.

Coal for the Electricity Department.
9,000 tons Clifton Hall washed pea nuts (22s. per ton).—A. Knowles & Son.
6,000 tons No. 2 washed slack (22s. 6d. per ton).—Clifton & Kersley Coal Co., Ltd.
900 tons Wigan washed rough slack (20s. 10d. per ton).—Wigan Coal and Iron Co., Ltd.
2,000 tons Pemberton best slack (20s. 10d. per ton).—P. Andrew. (Total amount, £19,670).

**Southern Railway Electrification (S.E. & Chatham Section).**
490 passenger carriages and 251 motor-driven air compressors.—Metropolitan-Vickers Electrical Co., Ltd.
508 300-h.p. railway motors.—English Electric Co., Ltd. (Approx. amount of the two contracts, £600,000.)

## FORTHCOMING EVENTS.

**Shipping, Engineering, and Machinery Exhibition.**—August 31st to September 22nd. At Olympia, W.

**Institute of Metals.**—September 10th to September 13th. At Manchester. Autumn meeting.

**National Association of Supervising Electricians.**—Tuesday, September 11th. At St. Bride Institute, E.C. At 7.30 p.m. Presidential address by Mr. W. E. Highfield.

**Whitworth Society.**—Tuesday, September 11th. Visit to the International Shipping, Engineering, and Machinery Exhibition at Olympia, W. Reception 4.30 p.m.

**British Association for the Advancement of Science.**—September 12th to September 19th. At Liverpool. Annual meeting.

## THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Requests for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of :—

Violetta violet ray sets.

# NOTES.

**A Diesel-Electric Barge.**—The Westinghouse Electric and Manufacturing Co. has been awarded the contract for the pilot-house and engine-room control and electric propelling and switching equipment for the first Diesel-electric barge, now being built at New York for the Standard Oil Co., of New Jersey, by the Newport News Shipbuilding and Dry Dock Co. The barge will be the largest self-propelled vessel of the Standard Oil Co.'s fleet in the Chesapeake Bay. It will be 210 ft. long, 38 ft. wide, 16 ft. deep, and have a capacity of 11,000 barrels. McIntosh and Seymour Diesel engines will drive two Westinghouse generators of 185 kW at 275 r.p.m. The speed of the barge will be about nine knots an hour and it will be completely equipped electrically. The main Westinghouse motor of 455 h.p. will drive the propeller at 100 r.p.m.—*Modern Transport.*

**The World Power Conference.**—In response to invitations for American participation in the World Power Conference to be held in London next year under the presidency of the Earl of Derby, more than twenty engineering and industrial organisations in the United States have appointed representatives to a committee of arrangements, which has planned the following organisation, in which electrical men are prominent:—

*Honorary Chairman*: Secretary of War Weeks.

*Honorary Vice-Chairmen*: Secretary Work, Secretary Wallace, Secretary Hoover, Gen. Guy E. Tripp, Owen D. Young, Samuel Insull, Prof. Lester P. Breckenridge, Sydney Z. Mitchell.

*General Chairman*: O. C. Merrill, executive secretary, Federal Power Commission.

*Vice-Chairman*: H. J. Pierce, president, Washington Irrigation & Development Co.

*Secretary*: W. M. Steuart, Bureau of the Census.

*Treasurer*; H. M. Addinsell, Harris, Forbes & Co., New York.

*Executive Committee*: W. M. Steuart, Peter Junkersfeld, Calvin Rice, David P. Rushmore, Calvert Townley, H. M. Addinsell, H. I. Harriman, Fred Low, John W. Lieb.

Working committees have been appointed, and General Chairman Merrill is now in London gathering information as to the scope and details of the American participation in the conference.—*Electrical World.*

**The "La Playa."**—The trials of the motor ship *La Playa* will, according to the *Motor Ship*, take place next month. In this vessel are installed four Camellaird-Fullagar engines, each driving a generator supplying power to electric motors coupled to the propeller shafts.

**Fatalities.**—The *Scotsman* reports that a fatal accident occurred at the Buckholmside Skinworks, Galashiels, on August 27th. Building operations have been in progress, following the recent disastrous fire at the skinworks, and a man named Andrew M'Laren, who was in the employment of Messrs. Laurence M'Laren & Sons, was working on the roof of a part of the building. When descending a ladder, M'Laren slipped, and, in an endeavour to save himself, clutched a live electric wire of a travelling crane used for the conveyance of bales of wool and skins. One of the workers, named Murphy, tried to pull M'Laren off the wire, and in doing so also received a partial shock, but recovered quickly. A few minutes elapsed before the current was cut off. Artificial respiration was resorted to for fully an hour and a half, while oxygen was supplied from a cylinder, but despite all efforts M'Laren never regained consciousness, and died.

Sidney Davies, a Treforest labourer, was crushed to death at the South Wales electrical power station at Upper Boat, near Pontypridd, on August 28th, by a cast-iron door falling on him. Stanley Simms, of Upper Boat, another labourer, was seriously injured.—*The Times.*

**A "Live" Lamp-post.**—A *Times* correspondent reports that a number of donkeys grazing on Ealing Common, strayed into Gunnersbury Avenue. While they were being driven back to the common one of them bumped against an electric lamp-post and was killed by an electric shock. A telephone message to the borough council brought electricians promptly to the spot, and the lamp-post was found to be very much "alive." The necessary steps were taken to isolate it. When the donkey fell, a man with a piece of iron rod in his hand touched the animal, one leg of which was against the post, and he, too, received a shock.

**Radio Notes.**—In connection with the extension of the Handley Page London-Paris air service to Zurich, a temporary radio telephone station was established at the Zurich aerodrome by Marconi's Wireless Telegraph Co. at very short notice. Within six days of the order being received in London the station was in operation at Zurich. It consists of a Marconi standard A.D.2. aircraft transmitter and receiver, with sub-control attachment. Marconi aerodrome stations are now in operation at Croydon, Haren, Ostend, Cologne, Geneva, and several aerodromes in Spain.

Attempts have recently been made both in America and France as well as in this country to install radio telephonic apparatus on express trains. On a fast train running in the U.S.A. between Hoboken and Buffalo this has been done, and passengers can continue conversations with their friends which were interrupted by the train starting; they can also receive radio telegrams from their friends while the train is in motion. In *Nature* is a reference to the experiments which have been carried out by three of the French railway companies in making "concert" cars. On the Paris-Orléans railway, the experimental saloon cars had two loud-speaking telephones fitted at each end of the cars. Up to a distance of 210 miles from Paris, the Eiffel Tower concerts were heard quite satisfactorily. As a rule the concerts were better heard than the news items. When the train goes through deep cuttings the sound is notably reduced, and when going through long tunnels it almost disappears. As there are at present only three large broadcasting stations in the neighbourhood of the railway, and as they are near Paris, the concert cars have only a limited use. With the arrangements used it was found that the large radio telegraphic stations near the Bordeaux-Paris line produced serious disturbances. When going round curves also, discordant sounds were heard due to the friction of the flanges of the wheels on the rails.

Some interesting work has recently been done on the Continent in developing a system of duplex radio telephony on trains, and the experiments carried out have been extremely successful. According to the *Wireless World and Radio Review*, this new method differs from older attempts in that the transmission is a combination of both wired and radio telephony. A fixed transmitting station energises the wires such as are used for telegraph or telephone purposes. The receiving aerial is arranged along the top of the railway carriages. There is no connection between this aerial and the telegraph and telephone wires which run along the side of the railway, so that between these two points the transmission is actually radio. The earth connection of the apparatus installed on the train itself is made through the wheels to the rails of the track on which the train travels; no interference occurs with the ordinary use of the wires for telegraphic or telephonic purposes. If the traveller wishes to communicate by telephone with a friend in a distant town he makes use of the radio system on the train to ring up the ordinary telephone exchange. He is then connected directly with the telephone of the subscriber in the town and a conversation can be carried on without any interference.

The height of the aerial on the moving train is decided by the fact that the train has to pass under bridges, and since the distance which can be communicated over is largely dependent upon the height of the aerial, this has been a serious drawback. With the present system, however, the actual transmission has only to cover a distance of two or three yards to the adjoining telephone wires, and consequently an enormous saving of energy is the result, and a very inefficient aerial system will suffice.

Valves are used to generate the high frequency oscillations, the apparatus corresponding largely to an ordinary wireless telephone transmitter. At the present time on the trains fitted with wireless there is an official who arranges to put passengers in touch who desire to carry on a conversation. It is not, however, essential that this official should be in attendance, as new apparatus has been devised whereby simply lifting the receiver puts the circuits into operation, and they being tuned to definite wavelengths no manipulation is necessary. The system has been developed by the Huth Company, in Berlin.

Following entirely successful experiments, says the *Evening News*, on board the *Mantua*, the P. & O. Co. proposes to install direction-finding gear on all its mail steamers.

**Defective Blind Children.**—To make provision for children who are not only blind, but also afflicted with some other disability, Miss Ellen Terry, president of the Braille and "Servers of the Blind" League, appeals for funds to establish national homes at Reigate. Contributions should be sent to her at 3, Upper Woburn Place, W.C.1.

**Belgian Radium.**—The new plant which has been erected near Antwerp to deal with the ore from the Belgian Congo, is expected to produce three or four grammes of radium (element) per month. As this quantity is in excess of the world's present demand, endeavours are being made to find industrial uses for the metal. The American ore mines have been closed for the present, owing to the comparatively rich content of the Congo ore, which has enabled the price per gramme of radium to be reduced very materially.

**Appointments Vacant.**—Plumber-jointer, for the Salford Corporation Electricity Department; lecturer in machine design (part time), for the Bradford Technical College; junior mains assistant (76s.), for the Wolverhampton Corporation Electrical Engineering Department; general manager for the Belfast Corporation Tramways. (See our advertisement columns to-day.)

**Lessons in Electric Cooking.**—At the last meeting of the London County Council, held on July 31st, 1923, the following resolution was adopted on the motion of Mr. C. A. G. Manning, a member of the Labour Party on the Council:—"That it be referred to the Education Committee to consider and report whether or not, at appropriate centres, cooking by electricity should be taught."

**Magnetically-operated Brakes.**—The question of how best to reduce the effort involved in operating the brakes on motor vehicles has received considerable attention of late, says the *Commercial Motor*, and is of particular importance with regard to proposed four-wheel braking systems. An added difficulty arises when the brakes have to be applied to the front wheels, it being difficult to arrange a strong and effective mechanical method for operating the shoes which will not be subject to undue wear after prolonged usage. It is, therefore, of interest to notice that the idea of operating the brakes magnetically has been revived in a patent recently granted to Mr. F. W. Lanchester in conjunction with the Daimler Co., Ltd. The patent embodies a series of electromagnets which forces an expanding split-ring into contact with the drum, servo action being relied upon to produce the necessary braking effect. The simplicity with which such brakes could be controlled is immediately obvious, flexible electrical leads being the only connections required between the vehicle chassis and the brake-drums.

**Radio Broadcasting in America.**—According to Government figures there were in the United States on July 2nd no fewer than 581 "active" broadcasting stations, but a close survey showed that many of the stations had ceased to operate. The actual number of stations in working order was 450, says *The Times*, which points out that nearly 46 per cent. of the broadcasting stations which have been licensed in the United States—826 in all—have either been discontinued or are now inactive. Financial reasons are given for the closing of 25 per cent. of the discontinued stations; about 16 per cent. were apparently never placed in service; 15 per cent. were discontinued because of the competition of better stations in the same territory; and 14 per cent. because the results, from the public point of view, were unsatisfactory. The radio and electrical companies, which have been most active in assembling broadcasting equipment from miscellaneous parts, have discontinued 121 of their 339 stations. The various interests maintaining broadcasting stations, according to the Government returns, were :—

| | Active. | Discontinued |
|---|---|---|
| Radio and electrical companies ... ... | 218 | 121 |
| Educational institutions ... ... ... | 88 | 13 |
| Newspapers and publishers ... ... | 68 | 26 |
| Department stores ... ... ... ... | 36 | 2 |
| Business unknown ... ... ... ... | 31 | 26 |
| Automobiles, batteries, cycles ... ... | 26 | 2 |
| Churches and Y.M.C.A. ... ... ... | 20 | 4 |
| Private ... ... ... ... ... | 12 | 6 |
| Hardware ... ... ... ... ... | 11 | 3 |
| Musical instruments, jewellery ... ... | 10 | 9 |
| Police, fire, municipal ... ... ... | 7 | 2 |
| Clubs and societies ... ... ... ... | 7 | 5 |
| Railroads and power companies ... ... | 7 | 4 |
| Telegraph and telephone companies ... | 6 | 0 |
| State bureaus ... ... ... ... | 5 | 1 |
| Banks and brokers ... ... ... ... | 5 | 1 |
| Dental, medical, drugs ... ... ... | 5 | 1 |
| Parks and amusements ... ... ... | 4 | 3 |
| Stock, poultry, and grain companies ... | 4 | 1 |
| Theatres ... ... ... ... ... | 4 | 1 |
| Mining, marble, and oil companies ... | 3 | 3 |
| Real estate ... ... ... ... ... | 2 | 1 |
| Laundries ... ... ... ... ... | 1 | 0 |
| Playing card manufacturing ... ... | 1 | 0 |

**Educational.**—Glasgow Technical College.—In connection with the department of electrical engineering of the Glasgow Technical College, a course of ten lectures on "Wireless Telegraphy and Telephony" is to be given by Prof. G. W. O. Howe, Glasgow University, on Friday evenings, beginning on October 12th. The fee for the course will be 10s.

Whitworth Scholarships.—Under the new regulations, Whitworth Senior Scholarships (£250 a year for two years) have been awarded to Messrs. A. Beale, late shipwright apprentice, Portsmouth, and G. Ashworth, late draughtsman, London. Six Whitworth Scholarships (£125 a year for three years) have been awarded to Messrs. F. Brailsford, E. H. Harwood, F. E. Postlethwaite, R. Pattison, R. J. Sydenham, and H. G. Beer; all except R. Pattison are, or have been, apprentices in H.M. Dockyards at Pembroke, Portsmouth, or Devonport. Twenty-five Whitworth £10 prizes were awarded to unsuccessful competitors for scholarships; of these 22 hailed from H.M. Dockyards, and two from the Royal Arsenal, Woolwich. There were 19 competitors for senior scholarships, and 142 for the ordinary scholarships. About half the successful candidates were electrical fitter apprentices.

Northampton Polytechnic Institute.—For the full time courses in engineering and technical optics a special entrance examination is to be held at the end of September; the 1923-24 session for evening courses commences on Monday, September 24th. Particulars, with conditions of entrance, can be obtained at the Institute or from the Principal, Dr. R. Mullineux Walmsley. (See our advertisement pages to-day.)

**United States Electric Vehicle Market.**—Manufacturers of electric trucks report that although business during the month ended August 23rd has been quieter than in any corresponding period this year, their plant continues operating at capacity and two companies have sufficient orders on hand to keep them fully employed for at least sixty days. An ice cream company, early in August, bought six 5-ton trucks and the United Electric Light & Power Co. of New York has just ordered the following: Two 5-ton trucks, each equipped with electric winches for pulling cables in and out of ducts; one 2-ton and five 1-ton trucks. The last will be of special body design and will carry a complete stock of electrical goods, including washing and sewing machines, radiators, electric irons and other articles used in the home; each truck will be in charge of a salesman, who will be sent to suburban districts of New York, where a house-to-house canvass will be made, demonstrations given, and orders filled on the spot. This novel plan to increase sales of electrical goods used in the home has aroused keen interest among makers of electrical equipment.

One of the largest truck manufacturing companies reports that sales during the first six months of 1923 showed an increase of 44 per cent. over the total for the corresponding period of last year. The Walker Vehicle Co., of Chicago, is erecting an addition to its plant at an estimated cost of $1,000,000. The Edison Co., of New York, is erecting a large service station at New York, three floors of which will be used by the electric truck division of the company. There will be three charging boards. No. 1 will contain 132 circuits, of 100 amperes each; board No. 2 will consist of 10 panels; the third board will be installed in the battery test room.

Eleven electric trucks, valued at $15,320, were exported during June, against 36, valued at $58,814 in the corresponding month of last year.—*Reuter's Trade Service* (New York).

**Vigorous Advertising.**—Among a number of "catchy placards for window demonstration" detailed in a recent issue of the Toronto *Electrical News* is the following:—

"Don't kill your wife with a washboard—let the Eden washer do the work."

This is a new version of a classical example of what *Punch* calls "commercial candour."

**Institution of the Rubber Industry.**—The programme for the coming session includes nine papers to be read in London, commencing on September 17th, and five to be read at Manchester and Birmingham, dealing generally with manufacturing processes, rubber products, and allied subjects.

**Whitworth Society.**—A programme has been drawn up for the visit of the Society to the Shipping, Engineering, and Machinery Exhibition on September 11th, including tea and dinner. Any Whitworth Scholars who have not received notice of the function are asked to communicate with the Hon. Secretary, c/o Institution of Mechanical Engineers, Storey's Gate, S.W.1.

## OUR PERSONAL COLUMN.

***The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.***

The marriage took place last week of Mr. F. C. Brown, managing director of F. T. Brown (Electricity), Ltd., electrical contractors, of Union Street, Coventry, and Miss C. Harley, daughter of the late Mr. J. Harley, of Colsall.

Mr. E. S. Haslam, deputy electrical engineer to the Penang Municipal Commission, has resigned, and Mr. Thomas Rogers, chief assistant engineer, has been appointed his successor. Mr. W. J. Williams, the engineer-in-chief, was chief assistant engineer in the Electricity Department, Shanghai, up to June, 1920, and Mr. Rogers was also in the service of the Shanghai Municipal Council until he joined Mr. Williams at Penang in May, 1922.

Friends of Mr. C. C. Atchison, formerly borough electrical engineer of Rochdale, will regret to learn that his younger daughter Viola died as the result of a motor-cycle accident under very tragic circumstances near Lyme Regis, on August 25th.

Mr. D. Dyson Rayner has severed his connection with Rayner & Heald, Ltd., and commenced business on his own account at 26a, Curzon Street, Derby, as manufacturer of dynamos and motors.

Manchester Corporation is recommended to make the following increases in salary to officials of the Electricity Department: Mr. H. C. Lamb, deputy chief electrical engineer, £900 to £1,000; Mr. W. E. Foden, financial superintendent, £700 to £800; Mr. F. T. Guildford, chief engineer's and manager's secretary, £425 to £475; Mr. B. Bennison, accountant, from £410 to £450; Mr. I. Johnson, accounts and pay clerk, from £410 to £450.

Mr. H. S. Binns has relinquished his appointment with Messrs. Ferranti, Ltd., and has started in business as an

agent. He has taken over the representation of the Hackbridge Electric Construction Co., Ltd. (for transformers), and the Hackbridge Cable Co., Ltd. (for cables), for the Manchester and Birmingham districts. For the present his address will be 10, Parkfield Road, New Moston, Manchester.

Mr. FRANK RISCH informs us that he is not now representing the meter interests of the Electrical Apparatus Co., Ltd. His private address remains unchanged.

It is reported that Mr. C. H. MERZ is on the way to South Africa on business connected with the electrification of the Government railways.

Mr. JAMES DALRYMPLE, general manager of the Glasgow Corporation tramways, has left for a visit to Canada and the United States.

At a dinner recently held to mark the transfer of the Bo'ness electricity undertaking from the National Electric Construction Co. to the Town Council, Mr. H. C. BABB, the retiring engineer and manager, was presented with a case of pipes by the Provost of the town on behalf of Mr. Babb's former staff and colleagues.

**Obituary.**—MR. C. H. JESSOP.—We regret to record the death of Mr. C. H. Jessop, outside engineer to Brittain's Electric Motor Co., after two months' illness. He had been with the firm for 30 years.

Mr. D. MOTT.—The death is announced of Mr. David Mott, who had for upwards of 16 years been on the staff of the Chesterfield Corporation Electricity Works. He was 50 years of age.

## NEW COMPANIES REGISTERED.

**Spencers (Electrical), Ltd.** (192,195).—Private company. Registered August 29th. Capital, £1,000 in £1 shares. To carry on the business of import and export merchants and agents for the importation and exportation of electrical goods, &c. The subscribers (each with one share) are:—Violet B. Walker, 3, Cobbold Road, Leytonstone, bookkeeper; E. F. Spencer, 7, 8 and 9, White Cross Place, Wilson Street, E.C., manager. The first directors are not named. Registered office: 7, 8 and 9, White Cross Place, Wilson Street, E.C.2.

**Automatic Co. (Bristol), Ltd.** (192,119).—Private company. Registered August 25th. Capital, £3,000 in £1 shares (1,000 preference and 2,000 ordinary). To adopt an agreement with G. H. Keat, trading as the Automatic Alarm Co., of 7 and 9, Nicholas Street, Bristol, and to carry on the business of manufacturers and maintainers of electrical or other appliances for advertising, burglar and other alarms, builders, decorators and general contractors, general, publicity, electrical and advertising agents, dealers in wireless appliances, &c. The first directors are:—G. H. Keat, 7 and 9, St. Nicholas Street, Bristol, general advertising contractor; A. J. Webber, 12, Waverley Road, Redland, Bristol, produce broker; G. H. Mason, 55, Allington Road, Southville, Bristol, builder (all permanent, subject to holding 500 ordinary shares each, with £260 each per annum as remuneration). Solicitors: Glyde, Kerslake and Scammell, Foster's Chambers, 17, Small Street, Bristol.

**Electrical Importers (Hull), Ltd.** (192,139).—Private company. Registered August 27th. Capital, £205 in £1 shares. To carry on the business of manufacturers, repairers, and importers of, agents for, and dealers in electrical goods and accessories of all kinds, fittings, switchboards, recorders, clocks, time switches, flashers, engine controls, ventilating fans, thermometers, gauges, blowers, vacuum cleaners, transformers, balancers, rectifiers, batteries, motors, dynamos, accumulators, scientific, magnetic, telegraphic and mathematical instruments, manufacturers of motor cycles and cars and engines and fittings for the same, manufacturers of wireless apparatus and accessories, &c. The first directors are:—A. Shaw, 25, Albany Street, Hull, electrical engineer; J. Shaw, 6, Cornwall Gardens, Raglan Street, Hull, electrical engineer. Registered office: 11, Portland Place, Hull.

**Industrial Products, Ltd.** (12,816).—Private company. Registered in Edinburgh August 23rd. Capital, £5,000 in £1 shares. To acquire the business of manufacturers of electrical compounds and special paints carried on by G. Hollinshead, E. J. Aitken, and M. H. Beattie at 17, Herschill Street, Glasgow. The first directors are:—J. Russell, 51, High Street, Linlithgow, solicitor; J. Brock, Cross House, Linlithgow, building contractor. Qualification, £50 shares. Registered office: 17, Herschill Street, Anniesland, Glasgow.

**Brown Pistol Sparking Plug, Ltd.** (192,091).—Private company. Registered August 24th. Capital, £2,000 in £1 shares. To adopt an agreement with A. G. Brown for the acquisition of the British and foreign patents relating to his sparking plug inventions, and to carry on the business of electrical engineers, manufacturers of and dealers in sparking plugs, &c. The permanent directors are:—J. W. Geddes, 118, Old Park Ridings, Winchmore Hill, N.21, mechanical engineer; H. Benwell, 275, Putney Bridge Road, Putney, S.W., butcher; A. G. Brown, 116, Putney Bridge Road, Putney, S.W.15; A. P. Haslam (managing director), 116, Putney Bridge Road, Putney, S.W.15. Qualification, 50 shares. Registered office: 116, Putney Bridge Road, Putney, S.W.15.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Magnetic Transmission Co., Ltd.**—Issue on August 23rd, 1923, of £600 debentures, part of a series already registered.

**British Radio Sales Co., Ltd.**—Debenture dated August 18th, 1923, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. Hutchison, 539, East First South Street, Salt Lake City, Utah, U.S.A.

**Mills English & Co., Ltd.**—Issue on July 31st, 1923, of £2,500 debentures, part of a series already registered.

**Triumph Electric Manufacturing Co., Ltd.**—A. H. Warriner, of 47, Temple Row, Birmingham, was appointed receiver on August 20th, under powers contained in debenture dated February 19th, 1923.

**Hobart Manufacturing Co., Ltd.**—Satisfaction in full on August 10th, 1923, of mortgage dated December 7th, 1920, securing all moneys due or to become due, not exceeding £7,000.

**New Gutta Percha Co., Ltd.** (74,517).—Return dated May 28th, 1923. Capital, £125,000 in 50,000 preference shares of £1 each and 150,000 ordinary shares of 10s. each. 14,100 preference and 138,250 ordinary shares taken up. £30,475 paid, being £1 per share on 11,350 preference and 10s. per share on 38,250 ordinary. £52,750 considered as paid on 2,750 preference and 100,000 ordinary. Mortgages and charges, £30,000.

**Electrical Power Engineering Co. (Birmingham), Ltd.**—Return dated November 9th, 1922 (filed August 22nd, 1923).—Capital, £5,000 in £1 shares. 1,945 shares taken up. £600 paid. £1,345 considered as paid. Mortgages and charges, nil.

**Yorkshire (Woollen District) Electric Tramways, Ltd.** (71,916).—Return dated July 13th, 1923. Capital, £500,000 in £1 shares (250,000 preference and 250,000 ordinary). 200,035 ordinary shares taken up. £200,035 paid. Mortgages and charges, £40,000.

**Hooper's Telegraph and India Rubber Works, Ltd.** (40,947).—Return dated July 17th, 1923. Capital, £50,000 in £10 shares (1,000 preference and 4,000 ordinary). 1,000 preference and 4,000 ordinary shares taken up. £40,000 paid on the ordinary. £10,000 considered as paid on the preference. Mortgages and charges, nil.

**International Electric Co., Ltd.** (113,906).—Return dated January 10th, 1923 (filed July 10th). Capital, £31,000 in £1 shares. 30,100 shares taken up. £27,100 paid. £3,000 considered as paid. Mortgages and charges, £63,360.

**Ceag Miners' Supply Co., Ltd.** (138,208).—Return dated May 30th, 1923. Capital, £10,000 in £1 shares (9,000 ordinary and 1,000 preference). 8,804 ordinary shares taken up. £8,804 paid. Mortgages and charges, nil.

**Anchor Cable Co., Ltd.** (69,073).—Capital, £250,000 in £10 shares. Return dated May 31st, 1923. 6,500 shares taken up. £65,000 paid. £4,000 considered as paid. Mortgages and charges, nil.

**Hong Kong Tramway Co., Ltd.** (75,486).—Capital, £81,250 in 5s. shares. Return dated April 25th, 1923. All shares taken up and considered as fully paid. Mortgages and charges, nil.

**Standard Electric Co., Ltd.** (68,643).—Return dated June 11th, 1923. Capital, £10,000 in £1 shares (5,000 preference and 5,000 ordinary). 3,077 preference and 5,000 ordinary shares taken up. £4,377 paid, being £1 per share on 4,177 and 10s. per share on 400. £3,700 considered as paid, being £1 per share on 3,500 and 10s. per share on 400. Mortgages and charges, £300.

## CITY NOTES.

**Southern Brazil Electric Co., Ltd.**

A general meeting of the holders of the 6 per cent. mortgage debentures of the Southern Brazil Electric Co., Ltd., is to be held on September 10th for the purpose of considering resolutions to the effect:—(*a*) That the net revenue of the company available for payment of debenture interest in each of the years ending December 31st, 1923, to December 31st, 1927, inclusive, after paying necessary expenses and providing for the amounts due to the Inland Revenue, shall be paid by the company to Barclay's Bank, Ltd., to the order of the trustees, to be applied in paying the interest on the debentures as soon as the fund is sufficient for the payment of one complete coupon, and in the meantime any amount which cannot be so applied shall be carried forward until the amount so available is again sufficient to pay one whole coupon. (*b*) That such arrangement shall include the coupon due January 1st, 1928, and that any coupons which the net revenue aforesaid has not been sufficient to pay shall be paid out of the first surplus revenues of future years remaining after payment of the debenture interest and sinking fund for the year in question; and (*c*) That the resumption of the sinking fund payments be postponed until July 1st, 1928.—*Financier.*

**Brisbane Electric Tramways.**

In the official report of a meeting of the Brisbane Tramway Trust, held in June, it was stated that the Act under which the trust was constituted provided for the half-yearly payment of interest at the rate of 5½ per cent. per annum on such sum as the trust, with the approval of the Governor in Council, calculated would be the amount of purchase money for the tramways. As the work of the Valuation Board was not completed and the method of valuation had not been decided by the Supreme Court, arrangements were made for the trust to pay to the Brisbane Tramways Co. a sum of £50,000 on June 30th. This did not represent payment upon any fixed capital sum or for any definite period, but was simply on account of interest which might be due.—*Industrial Australian and Mining Standard.*

**Spanish Companies.**

*Sociedad Electra de Viesgo.*—The results of the working of this company in 1922 totalled 4,237,712 pesetas, against 3,007,680 pesetas in 1921. Deducting costs of working and other charges, a net profit of 1,296,702 pesetas was shown, from which a dividend of 15 pesetas, or 3 per cent. on the 35,000,000 pesetas capital of the company, was distributed. The previous year's dividend was 30 per cent. when the capital of the company was less than half its present amount, but the new installations are expected to bear fruit in the coming years.

*Sociedad anonima E. M. C. de Construcciones Electromecanices.*—The accounts showed a net profit of 196,191 pesetas, from which a dividend of 6.50 pesetas was declared.

The *Sociedad Tranvias de Sevilla* earned for the past year net profits of 698,697 pesetas, from which a dividend of 7.50 per cent. was distributed and 105,000 pesetas allocated as founders' shares.

*Tranvias y Electricidad de Bilbao.*—The past year's working of this company showed a lessening of the working costs, owing to the fall in the cost of coal. The receipts (3,494,354

francs) were 35,527 francs in excess of those of the foregoing year. The net profit available was 1,672,041, from which a dividend of 9.50 francs per share of capital and 10 francs complementary dividend was sanctioned.

**Barcelona Traction, Light and Power Co.** Gross revenue for 1922, $2,575,466, as compared with $2,065,537 for 1921 and $1,908,878 for the year 1920. Administration and general expenses absorbed $142,265, as against $160,936 for 1921, and the expenses of reorganisation and issue incurred during the year required $197,976, leaving available $2,235,225, as compared with $1,904,601 at December 31st, 1921. After providing $1,496,866 for interest on seven per cent. "A" bonds, six per cent. "B" bonds, six per cent. six-year bonds and seven per cent. thirty-year bonds, and service of the eight per cent. debentures, there remains available for interest on the six per cent. first mortgage bonds $738,359. Payment of 2 per cent. for the year on those bonds absorbs $715,273, leaving a surplus of $23,085, as compared with a deficit for the previous year of $156,872.

The meeting will be held in Toronto, on September 18th, at noon.—*Financial Times.*

**French Companies.** *Ateliers de Constructions Electriques de Delle.*—The general meeting passed the accounts for 1922, showing a net profit of 937,519 fr., about the same amount as in the foregoing year. A dividend of 60 fr. per fully paid-up share and 37.50 fr. per share, one quarter paid up, was declared, carrying forward 823,555 fr.

*Compagnie d'Electricité de l'Est Parisienne* (*Est Lumière*).—The accounts of this company for 18 months recorded a net profit of 4,391,351 fr., which, with the sum brought forward, 746,758 fr., made 5,138,110 fr., from which a dividend of 4 fr. gross per priority share and 15 fr. per ordinary share was distributed. During the year the company had secured three additional concessions, which are now under way. As a result of interruptions in the cables in 1922, a French newspaper states, the receipts of the French Transatlantic Cable Co. declined from 20,017,000 fr. in 1921 to 8,189,000 fr. last year. The rate of dividend is expected to be 22.50 fr. per ordinary share as compared with 37.60 fr. in 1921.

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**Stock Exchange Notices.**—Application has been made to the Committee to allow the following to be officially quoted:—

Tokio Electric Light Co.—Scrip, fully and partly paid, for £3,000,000 6 per cent. Sterling bonds.

The undermentioned have been ordered to be officially quoted:—

Hadfields.—£1,040,000 5½ per cent. first mortgage debenture stock.

**Belgian Company.**—The Société anonyme Etablissements Industriels G. Landau, of Brussels (91, Rue du Trône), has increased its capital to 925,000 fr. The Etablissements Jean Labouverie (Forest-lez-Bruxelles) has modified its statutes and increased its capital to 2,500,000 fr.

**South London Electric Supply Corporation, Ltd.**—Interim dividend on the 6 per cent. cumulative preference shares, less tax, and an interim dividend on the ordinary shares at the rate of 4 per cent., less tax.

**Brazilian Traction, Light and Power Co., Ltd.**—Quarterly dividend of 1¼ per cent. on the cumulative preference shares.

**Pinchin, Johnson & Co., Ltd.**—Interim dividend of 6 per cent. actual on the ordinary shares, for the half-year ended June 30th, 1923.

**Oxford Electric Co., Ltd.**—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares.

**Canadian General Electric Co.**—Quarterly dividend of 1 per cent. on common stock and half-yearly dividend of 3 per cent. on preference stock.

**British Electric Transformer Co., Ltd.**—The directors announce that, owing to trade depression and foreign competition in the electrical machinery industry, they are at this time unable to pay the dividend due on September 1st on the 7 per cent. cumulative preference shares.

## STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets have been subjected during the past few days to such a variety of shocks as might have been expected to shake prices severely. The terrible catastrophe in Japan and the friction between Italy and Greece are in themselves sufficiently unfavourable factors to lay a restraining hand upon enterprise, and to bring in sellers of stocks and shares. In point of fact, however, there was not much stock offered, and once again it is proved that the markets are far more swayed by the factor of sluggish trade, which brings money into the Stock Exchange, than by outside events, the effect of which is more or less temporary.

One of the principal falls suffered in connection with the Japanese calamity took place in Tokio Electric 6 per cent. bonds. These came out a short time ago at 94, and were regarded in most quarters as an excellent investment of their kind. They had been largely taken by the investor pure and simple, and the earthquake-shock reduced the market to a state bordering on nominal. Scrip changed hands at 2½ discount. No news, so far as we are aware, has yet been received as to what damage has been done to the property, but, of course, information is anxiously awaited. A rally to 10 discount showed that faith in the company is active. Lively dealings are now taking place every day.

Cable stocks are steady, in spite of an attack which has been made upon them by a journal of whose existence it is safe to say the majority of the cable proprietors had not previously heard. There is the usual talk about cables becoming superseded by wireless. The circular appears to have been broadcast fairly extensively, because it has aroused a good many inquiries, and an answer has been issued to this effort. The reply points out that as the gas companies were not ousted on the introduction of electricity, so cable companies are not likely to be damaged by the wireless competition. Had wireless been discovered first, it is claimed that cables would have been welcomed as an improvement. The strength of the financial position of the cable companies is illustrated by reference to the huge reserve funds of the three principal members of the Eastern group. The chairman of the Eastern Telegraph Co., at the last meeting, pointed out the remarkable extensions in cable work that are being undertaken by Italy, the home of wireless telegraphy, by the United States, by the Pacific Cable Board, and by Germany. These arguments are set out fairly and reasonably, not in the nature of an unsupported statement, but as a studiously correct reply to statements calculated to disturb the confidence of cable proprietors in their stocks.

Prices on the week are scarcely changed. Globes are ¼ better, Eastern Extensions ¼ lower, but beyond this there are no quotable alterations. Marconis are quiet at 2 5/16, the friction between Italy and Greece having left the market undisturbed.

The South London Electric Supply Corporation has raised its interim dividend from the 2½ per cent., paid last year, to 4 per cent. now, an excellent result, which augurs well for shareholders in respect of the full year's working. The price of the shares is unchanged at 1¼. Westminsters are better at 9¼, and Kensington at 9¼. Notting Hill preference rose 5s., also to 9¼. Chelseas are a good market at 35s. Bromptons retain their rise to £2 per share. Bournemouth and Poole ordinary are better at 34s. buyers. The only change amongst preferences is a small decline in Metropolitan 4½ per cent., which have gone back to 17s. Edmundson's ordinary hardened to 3¼.

Brazilian Tractions, after a further dip to 43, recovered sharply on a rally in the rate of exchange, and braced up to 46, which left them 2 to the good on the week. Mexicans are rather erratic. It was generally supposed that with the formal recognition of Mexico by the United States, there would be a general rise in Mexican securities, but expectation has been disappointed, and, so far as the utility companies are concerned, the only changes are a small rise in Mexican Light and Power first bonds to 68½, with a fall of 2 to 74 in Mexico Tramways 5 per cent. bonds. Amongst other foreigners, Anglo-Argentine Trams first preference strengthened to 3. Mention has already been made of the *débâcle* in Tokio Electric sixes. Lima Light and Power scrip has gone back to 1¼ discount. Urban Electric debentures at 8 premium are a shade lower than they have been.

London United Tramways preference are being tipped in some quarters as likely to turn out a profitable speculation. We hear it said that the company is likely to resume payment of dividends on these shares, but the idea sounds fantastic, and not until some kind of re-organisation of capital takes place is there any particular likelihood of a return being made on these shares. The price of 2s. 9d. shows what amount of faith the market has in the possibility of early dividend resumption. British Electric Traction ordinary at 73¼ is a point lower, and London Suburban preference remain weak at 9s.

Central London ordinary stock has risen to 73, but the feature in this market is a sharp rise in Metropolitans, followed by another in Districts. Rumour, which gains strength account by account, insists that the Metropolitan will be taken over either by the Great Western or the London & North-Eastern, or both these two companies jointly, on the basis of a 4 per cent., possibly 4¼ per cent., guarantee, on Metropolitan stock. There is also a vague idea that District ordinary stock will be treated in somewhat similar fashion, though later on. Consequently, people are buying the stock at the present price of about 51¼, with a view to putting it away for the future. Districts received 3 per cent. last year, so that the stock pays a little under 6 per cent. on the money at the present price, though if it were to receive a guarantee of anything like 4 per cent., obviously the quotation would go up with a rush. This is simply a repetition of market gossip and expectation. Underground Electric income bonds are quoted ex the £3 net coupon, and have recovered part of the deduction.

British Electric Transformers fell 1s. to 13s., and the preference to 14s., on the passing of the dividend on the latter. India Rubber shares at 11s. 3d. show a loss of the 9d. gained last week. Automatic Telephones are easier at 20s. English Electrics have gone back a trifle. Rubber shares are good, on the firmness of the raw material, and there is an increase of business noticeable in this department.

# SHARE LIST OF ELECTRICAL COMPANIES.

### HOME ELECTRICITY COMPANIES.

| | Nom. | Dividend. 1921. | Dividend. 1922. | Price Sep. 4, 1923. | Rise or fall. | Yield p.c. |
|---|---|---|---|---|---|---|
| | £ | | | | | |
| Brompton Ordinary ... ... | 1 | 12 | 12 | 2 | — | £6 0 0 |
| Charing Cross Ordinary ... ... | 5 | 9 | 14 | 11½ | — | 6 5 10 |
| do. do. do. 4½ Pref. | 5 | 4½ | 4½ | 4¼ | — | 5 6 0 |
| Chelsea ... ... ... ... | 1 | 6 | 10 | 35/- | +6d. | 5 14 3 |
| City of London ... ... ... | 1 | 14 | 15 | 24½ | — | 6 1 0 |
| do. do. 6 % Pref. ... | 1 | 6 | 6 | 24/- | — | 5 4 4 |
| County of London ... ... ... | 1 | 8 | 10 | 2½ | — | 4 14 1 |
| do. do. 6 % Pref. ... | 1 | 6 | 6 | 23/9 | — | 5 1 1 |
| Edmundson's Ordinary ... ... | 3 | Nil | 7 | 8½ | + 1/16 | 5 18 5 |
| do. 6 % Pref ... ... | 5 | 12/- | 6 | 4¾ | — | 6 8 0 |
| Kensington Ordinary ... ... | 5 | 10 | 12 | 9½ | + ½ | 6 9 9 |
| London Electric ... ... ... | 3 | 4 | 10 | 4¾ | — | 6 17 6 |
| do. do. 6 % Pref. ... | 5 | 6 | 6 | 5⅝xd | — | 5 11 7 |
| Metropolitan ... ... ... | 1 | 7 | 8½ | 14⅝ | — | 5 6 3 |
| do. 4½ % Pref. ... ... | 1 | 4½ | 4½ | 17/- | −6d. | 5 6 0 |
| Newcastle-on-Tyne Ordinary ... | 1 | Nil | 2½ | 17/- | — | 2 18 10 |
| do. 5 % Pref. ... | 1 | 5 | 5 | 16/3 | — | 6 3 1 |
| do. 7 % Pref. ... | 1 | 7 | 7 | 23/6 | — | 5 19 2 |
| Notting Hill 6 % Pref. ... ... | 10 | 6 | 6 | 9½ | + ½ | 6 6 4 |
| North Met. Elec. 6 % Pref. ... | 1 | 6 | 6 | 22/- | — | 5 9 1 |
| Urban Ordinary ... ... ... | 1 | Nil | — | 15/- | — | Nil |
| do, 5 % Pref. ... | 1 | 2½ | 5 | 5 | — | 6 17 0 |
| St. James' and Pall Mall ... | 5 | 12 | 14½ | 11¾ | — | 6 3 5 |
| South London ... ... ... | 1 | 7 | 10 | 1⅞ | — | 5 14 4 |
| South Metropolitan Pref. ... | 1 | 7 | 7 | 24/6 | — | 5 14 8 |
| Westminster Ordinary ... ... | 5 | 10 | 12 | 9½ | + ½ | 6 6 4 |
| Whitehall Elec. Invst., 7½ % Pf. | 1 | 7½ | 7½ | 19/9 | — | 7 13 10 |

### HOME RAILS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented | Stock | 4 | 4 | 73 | +1 | 5 9 7 |
| Metropolitan ... ... ... | ,, | 2½ | 3½ | 74½ | +1¼ | 4 14 0 |
| do. District ... ... | ,, | 1 | 3 | 51½ | +1½ | 5 16 6 |
| Underground Electric Ordinary | 10 | Nil | Nil | 3 | — | Nil |
| do. do. "A" ... | 1 | Nil | Nil | 9/6 | +6d. | Nil |
| do. do. Income | Bonds | 4 | 5 | 98xd | −2 | *5 2 0 |

### TELEGRAPHS AND TELEPHONES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. ... ... | Stock | 6 | 6 | 101 | — | 5 18 10 |
| do. Def. ... ... | ,, | 1½ | 84/6 | 23½ | — | 6 9 0 |
| Chile Telephone ... ... | 5 | 6 | 6 | 6 | — | 5 0 0 |
| Cuba Sub. Ord. ... ... ... | 10 | 7 | 7 | 7½ | — | 9 6 8 |
| Eastern Extension ... ... | 10 | 10 | 10 | 17 | — ⅛ | 5 17 9 |
| Eastern Tel. Ord. ... ... ... | Stock | 10 | 10 | 173½ | — | 5 15 8 |
| Globe Tel. and T. Ord. ... ... | 10 | 10 | 10 | 17⅞ | + ⅛ | 5 15 1 |
| do. do. Pref. ... ... | 10 | 6 | 6 | 11½ | — | 5 6 6 |
| Great Northern Tel. ... ... | 10 | 24 | 22 | 27½ | — | 8 1 6 |
| Indo-European ... ... ... | 25 | 10 | 7 | 33½ | — | 5 4 6 |
| Marconf ... ... ... ... | 1 | 25 | 15 | 2 7/16 | — | 6 9 10 |
| Oriental Telephone Ord. ... | 1 | 12 | 12 | 1½ | — | *6 3 9 |
| United R. Plate Tel. ... ... | 5 | 8 | 8 | 6¼ | — | *6 3 1 |
| West India and Panama ... | 10 | Nil | Nil | 1/6 | — | Nil |
| Western Telegraph ... ... | 10 | 10 | 10 | 16⅞ | — | *6 0 0 |

### HOME AND FOREIGN TRAMS, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams. First Pref. | 5 | 5½ | 12½ | 3 | + 1/16 | 9 3 4 |
| do. do. 2nd Pref. | 5 | Nil | 5½ | 2 1/16 | — | 11 17 10 |
| do. do. 5% Deb. | Stock | 5 | 5 | 72½ | — | 6 18 0 |
| British Electric Traction Ord. | ,, | 4½ | 5 | 73½ | −1 | 6 16 1 |
| do. do. 6% Pref. | ,, | 6 | 6 | 100½ | — | 5 19 3 |
| Brazil Tractions ... ... ... | 100 | Nil | 4 | 46 | +2 | 8 14 0 |
| Brit. Columbia Elec. Rly. Pcc. | Stock | 5 | 5 | 80½ | — | 5 15 7 |
| do. do. Preferred | ,, | 5 | 96/- | 79½ | — | *6 1 0 |
| do. do. Deferred | ,, | 3 | 127/- | 89½ | — | *7 2 6 |
| do. do. Deb, ... | ,, | 4½ | 4½ | 80½ | — | 5 5 7 |
| Lond. & Sub. Trac. 5 % Pref. | 1 | 3½ | 5 | 9/- | — | 11 2 0 |
| London United Tram. Deb. ... | Stock | 4 | 4 | 61½ | — | 6 10 0 |
| Mexico Trams. 5 % Bonds ... | — | Nil | Nil | 74 | −2 | 6 15 2 |
| do. 6 % Bonds ... | — | Nil | Nil | 56½ | — | Nil |
| Mexican Light Common ... | 100 | Nil | Nil | 29 | — | Nil |
| do. Pref. ... ... | 100 | Nil | Nil | 56½ | — | Nil |
| do. 1st Bonds ... | — | Nil | 5 | 66½ | +1 | 7 6 0 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Babcock & Wilcox ... ... | 1 | 15 | 20 | 21 | — | *4 9 0 |
| British Aluminium Ord. ... | 1 | 10 | 5 | 18/3 | — | 5 9 7 |
| British Insulated Ord. ... ... | 1 | 15 | 15 | 2 7/16 | — | 6 3 0 |
| Callenders ... ... ... ... | 1 | 15 | 15 | 2⅜ | — | 6 6 4 |
| do. 6½ Pref. ... ... | 1 | 6½ | 6½ | 23/9 | — | 5 9 5 |
| Crompton Ord. ... ... ... | 1 | 10 | 5 | 3/8 | — | 8 17 6 |
| Edison-Swan ... ... ... | 1 | 10 | Nil | 5/- | — | Nil |
| do. do. 5% Deb. ... ... | Stock | 5 | 5 | 65 | — | 7 13 10 |
| Electric Construction ... ... | 1 | 10 | 10 | 1½ | — | 6 16 1 |
| English Electric ... ... ... | 1 | 8 | 5 | 17/3 | −6d. | 5 16 0 |
| do. do. Pref. ... ... | 1 | 6 | 6 | 19/6 | — | 6 3 0 |
| Gen. Elec. Pref. ... ... ... | 1 | 6½ | 6½ | 22/3 | — | 5 16 10 |
| do. Ord. ... ... ... | 1 | 10 | 5 | 18/6 | — | 5 8 8 |
| Henley ... ... ... ... | 1 | 15 | 15 | 2 7/16 | — | 6 11 7 |
| do. 4½ Pref. ... ... ... | 5 | 4½ | 4½ | 4¾ | — | 5 2 10 |
| India-Rubber ... ... ... | 1 | 10 | — | 11/3 | −9d. | — |
| Met.-Vickers Pref. ... ... | 2 | 8 | 8 | 2½ | — | 6 8 0 |
| Siemens Ord. ... ... ... | 1 | 10 | 10 | 2 | — | Nil |
| Telegraph Con. ... ... ... | 12 | 20 | 20 | 24 | −1 | *5 0 0 |

* Dividends paid free of Income Tax.

# MARKET QUOTATIONS FOR CHEMICALS AND METALS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only gener... and they may vary according to quantities and other circumstanc...

| CHEMICALS, &c. | Price (Sept. 5th. | Fortnight's Inc. or dec. |
|---|---|---|
| a Acid, Oxalic ... ... ... ... per lb. | 6d. | ... |
| a Ammoniac, Sal ... ... ... per ton | £60 | ... |
| a Ammonia, Muriate (large crystal) ,, | £52 | ... |
| a Bisulphide of Carbon ... ... ,, | ... | ... |
| a Borax ... ... ... ... ... ,, | £27 | ... |
| a Copper Sulphate ... ... ... ,, | £25 10s. | ... |
| a Potash, Chlorate ... ... ... per lb. | 4d. to 4½d. | ... |
| a ,, Perchlorate ... ... ,, | 4d. | ... |
| a Shellac ... ... ... ... per cwt. | £13 10s. | ... |
| a Sulphur, Sublimed Flowers ... ,, | £8 10s. | ... |
| a ,, Roll ... ... ... ,, | £8 | ... |
| a Soda, Chlorate ... ... ... per lb. | 3d. | ... |
| a ,, Crystals ... ... ... per ton | £5 10s. | ... |
| a Sodium Bichromate, casks ... per lb. | 4½d. | ... |
| METALS, &c. | | |
| b Aluminium, Ingots ... ... ... per ton | £115 to £120 | ... |
| b ,, Wire ,, ... ... per lb. | 1/9 to 2/6 | ... |
| b ,, Sheet ... ... ... ,, | 1/6 to 2/- | ... |
| p Babbitt's Metal and Anti-friction Metal— | | |
| Grade I ... ... ... per ton net | £185 | £9 inc. |
| Grade II ... ... ... ,, ,, | £131 | £5 inc. |
| Grade III... ... ... ,, ,, | £73 | £1 inc. |
| c Brass (rolled metal 2" to 12" basis) per lb. | 10d. | ... |
| c ,, Tubes (solid drawn) ... ,, | 1/0 to 1/0½ | ... |
| c ,, Wire, basis ... ... ... ,, | 10½d. | ... |
| c Copper Tubes (solid drawn) ... ,, | 1/1½d. | ... |
| c ,, Bars (best selected) ... per ton | £96 | £2 dec. |
| c ,, Sheet ... ... ... ,, | £96 | £2 dec. |
| c ,, Rod ... ... ... ,, | £96 | £2 dec. |
| d ,, (Electrolytic) Bars ... ,, | £69 10s. | £3/- dec. |
| d ,, ,, Sheets ... ,, | £145 10s. | ... |
| d ,, ,, Wire Rods ,, | £79 10s. | 25/- dec. |
| d ,, ,, H.C. Wire per lb. | 9¼d. | ½d. dec. |
| f Ebonite Rod ... ... ... ,, | 3/6 | ... |
| f ,, Sheet ... ... ... ,, | 3/- | ... |
| n Gorman Silver Wire ... ... ,, | 2/3 | ... |
| h Gutta-percha, fine ... ... ... ,, | 6/6 | ... |
| h India-rubber, Para fine ... ... ,, | 1/3 | ... |
| i Iron Pig (Cleveland Warrants) ... per ton | £5 2s. to £5 2s. 6d. | 9/6 to 10/- inc. |
| l ,, Wire, galv. No. 8, P.O. qual. ,, | £25 | ... |
| g Lead, English Pig ... ... ... ,, | £27 | 30/- inc. |
| g Mercury ... ... ... ... per bot. | £8 15s. | 7/6 dec. |
| e Mica (in original cases) small ... per lb. | 3d. to 3/- | ... |
| e ,, ,, medium... ,, | 4/- to 8/- | ... |
| e ,, ,, large ... ,, | 10/- to 20/- & up. | ... |
| p Phosphor Bronze, plain castings ,, | 1/2 | ... |
| p ,, drawn bars and rods ,, | 1/3½ | ... |
| p ,, rolled strip & sheet ,, | 1/3½ | ... |
| p ,, wire ... ... ... ,, | 1/3½ | ... |
| o Platinum ... ... ... ... per oz. | £25 | £3 inc. |
| d Silicium Bronze Wire ... ... per lb. | 1/1 | 3d. dec. |
| r Steel, Magnet, in bars ... ... ,, | 10d. | ... |
| n Tin, Block (English) ... ... per ton | £198 15s. to £199 5s. | £8 5s. to £8 15s. inc. |
| n ,, Wire, Nos. 1 to 16 ... ... per lb. | 3/- | ... |

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

**The "Maryland's" Auxiliary Generating Plant.**—On t... American battleship *Maryland* a remarkable Diesel-drive... dynamo installation is to be fitted. According to the *Mot... Ship*, there will be two 900-b.h.p. six-cylinder Busch-Sulz... engines with a normal speed of 350 r.p.m., which in the sh... will run at 300 r.p.m., allowing the dynamos to devel... 400 kW each. The ship installation comprises two exhau... gas boilers, the gases from each Diesel engine being deliver... to one boiler. The steam pressure is 50 lb. per sq. in. a... the heating surface 445 sq. ft., 424 tubes being provided ... each boiler. A by-pass arrangement allows the exhaust gas... to be diverted so as to permit cleaning of the boiler. It ... anticipated that, with the generators developing full pow... about 400-500 lb. of steam will be produced per hour, whi... will be utilised mainly for heating the fuel oil, the press... being throttled down to 10 lb. per sq. in. The Diesel engi... are arranged to run in normal circumstances on the same ... as is used for firing the ship's main boilers, but on starti... up for half an hour, and half an hour before shutting dow... gas oil will be utilised. These engines, we understand, a... the highest-powered sets installed for auxiliary purposes on ... ship.

**National Association of Supervising Electricians.**—T... 1923-24 session of the Association commences on Septemb... 11th, with the presidential address to be delivered by M... W. E. Highfield, M.I.E.E. The president is taking as ... subject "The Manufacture of Steam," and will deal with t... boiler-house from various aspects. Mr. F. T. Alldread, ch... man of the N.A.S.E., will preside at the meeting. A spec... Committee of the Association has awarded scholarships to ... Heighway, Manchester (value £6), and R. W. J. Stark, Ed... burgh (£7).

# A CONSISTENT WORKS POLICY.

By J. O. KNOWLES, B.A.

There are certain matters of works administration over which a works manager has usually incomplete control, being dependent on the support of the higher administrative officials (usually the general manager or managing director). Even if the works manager and foremen are not wholly engrossed in administrative work and have some leisure to think over principles on which to base their more important decisions, it is rather the concern of those responsible for the general conduct of the business to formulate a policy, and to inspire the works staff along definite lines of action.

Many firms will, of course, consider that a "works policy" is a mere abstraction of no business value, and regard any discussion of business aims as "academic." The aim of their business is to make money. Good! And many firms have made much money by acting not only on the principle of making money but of giving service, or of pleasing the customer, or of maintaining quality. Certain slogans have undoubtedly been of use, not only in selling the goods, but in producing them, but as the general public hear more of the slogans that effect sales than of those which increase production, the latter have received less popular notice. There is therefore the more hope of meeting competition by using "works slogans" to inspire the staff to greater effort.

There is no need to destroy the permanence of an effort to work up staff enthusiasm by exaggerated "internal publicity" of a new or newly formulated works policy. A "new broom" in the administration may attempt to "re-educate" the staff by conferences on policy, prominent notices such as "quality always" throughout the works, or lectures and leaflets broadcast at frequent intervals, but such "intensive" methods, when used to cultivate enthusiasm and co-operation amongst the staff, are liable to stimulate a mushroom growth which passes away and leaves an added dreariness around. A consistent works policy in an established and sound business should be fostered and maintained in many unobtrusive ways, and should be the effect of "personality" rather than of exhortation.

When a business is growing beyond the immediate control of its founders, the formulation of a works policy becomes of greater importance. As long as the founders are actively interested in at least the main details, the general conduct of the business will be in line with their ambitions and character, for these qualities will have built up the business into its present form. To continue the tradition so established requires a more conscious appreciation of the principles by which success has been gained, so as to maintain the same qualities consistently and preserve in the "second generation" the goodwill established by the founders.

With the sales policy this article is not concerned, except in so far as it affects works production. It is assumed, however, that the business has been developed along specialist lines, so that the majority of the orders accepted are for goods of a type which the works is best fitted to produce. Sales and works policies here interact and are interdependent, for the efficiency of the works departments can soon be lowered if orders are accepted simply because they can at the moment be obtained, regardless of the disorganisation and inconvenience caused by the manufacture of the goods in the works. To preserve the goodwill (and the good services) of the works staff, it is first of all necessary to maintain some consistency in the type of orders booked, so that the flow of work through the shops, if it cannot be steady, may be at least specialised, so as to encourage the development of more intensive and specialised production methods.

It follows naturally from specialised and increased production of certain types that work must be subdivided into more distinct operations, particularly in the assembly and fitting departments. It need not be assumed that large quantities of any item must be ordered and stocked in order to gain advantages from subdivision of operations. This is a point where an ill-considered general policy may reject the idea of any considerable improvement in production methods, because there is no prospect of "quantity production" on the present or even on an improved output. An over-reaching policy may, on the other hand, result in an imitation of "quantity production" methods where the quantities produced do not justify the necessary expenditure on tools, preparations and organisation. A reasonable policy, however, will encourage the subdivision of operations in such a way that individual assemblers or fitters will be trained on certain special types of work, even though no two consecutive jobs are exactly the same. It is quite possible by special study to effect considerable economies in labour costs by training certain workers until on a particular class of operation they are more skilled than anyone else in the factory, thereby increasing their value to the firm and to themselves. It will probably be necessary to make alterations to plant lay-out and routine to enable operations to be thus subdivided without involving undue transit of work, but when directed by a dominant policy, such difficulties are more fully overcome.

At least in the machine shop true "repetition" work will be fairly common. Now it is easy to find instances in many works of parts machined in jigs and fixtures for "stock" which are afterwards "fitted" by hand. It is often somewhat difficult to preserve in the same shop a really clear distinction between the standard of accuracy required in machining parts which will be individually fitted and others which are made for stock. Even a complete set of jigs, fixtures and gauges does not positively ensure interchangeability, and as a matter of general policy, "assembly without fitting" should be a watchword with everyone concerned in production for stock.

There is not infrequently a division of interests and some friction between assembly foremen, machine shop foremen, and inspectors. Some rivalry is good, but in the absence of a basic principle accepted by them all (such as that just mentioned), disputes are apt to develop ill-feeling just when the demand for greater production is insistent and everyone's co-operation is needed.

It often happens that a firm's works policy is sound as regards both the machining and assembly sections, but that both are hampered by irregular and short supplies of material. The stores department is "non-productive" and subsidiary to the "producing" departments. If a man is of little use anywhere else, he may be made a storekeeper. Perhaps a storekeeper's labourer is only a "fetch and carry" man, but the general policy should include a definite responsibility for the storekeepers which will win respect from the producing departments—if the responsibility is justified.

Few stores have a place for everything. This is not of importance, for storekeepers are chosen for or develop their memory. Storekeeping arrangements are a departmental matter with which general policy is only concerned if other departments are affected. Now there is always a certain indefiniteness about future requirements of stock materials and parts which is apt to produce a certain indefiniteness in stores organisation. A counter-acting insistence on definiteness can do much to improve every section of the work. What materials and parts are kept in stock, and what are only ordered as required, should be definitely known to all concerned. Stock records, if kept at all, should be checked for accuracy oftener than once a year. Information as to dates and quantities on outstanding orders should be

obvious without a search. Batches of material sent for assembly should be complete, or if incomplete because of special urgency, the shortage should be unmistakably remembered until rectified. Maximum and minimum stocks should be known as definite quantities and often revised because of a definitely known change in demand.

So for each department, whether productive or non-productive, there are fundamental principles of action which make the difference between a mere departmental outlook and a real co-operation between all concerned in production. It is therefore a duty of the higher officials of the business to keep before each department the general principles by which their most important actions and schemes are to be judged. Generally speaking, it is useless to pretend that the statement of an abstract principle has much effect on a departmental manager apart from its particular application to a problem in hand. It is therefore the more important that when any problem is under discussion with the management, a decision should be linked up with a reiteration of the general policy so far as it concerns the immediate problem. Each departmental manager is then made to feel that he is working under something more than arbitrary authority.

It is one of the most certain facts about a business too large to be controlled directly and in detail by one head, that arbitrary decisions produce discontent amongst the staff. The latter are not working wholly for one man, they are working for a company, and if the company is to gain the loyalty which an individual of personality can attract by his consistent qualities, then the company's policy must be understandable, so that the staff can rely on their efforts being appreciated. A man who is keen on his job is keen to know by what the company will judge his work, and it is heartening to know that if he follows a certain line of action in his department, the company, as represented by its higher officials, will be consistent enough to appreciate the results after his months of effort in that direction.

Policies must change in detail in course of time. There has to be a natural "channel" through which the decisions of the directorate on policy are conveyed to the staff. The more personal this "channel" is made the better. He is a good managing director or general manager who can convey the impression in every discussion with his departmental heads that he appreciates the ways in which each will gain most kudos from the company in his own work.

# THE MUNICIPAL TRAMWAYS ASSOCIATION (INC.).—III.

## ANNUAL CONFERENCE.

### Tramways as a Municipal Asset.

Alderman Clark's paper on this subject, which was abstracted in our issue of August 24th, was discussed on August 23rd.

Councillor T. Woffenden (vice-chairman, Huddersfield) called attention to motor 'bus competition. Huddersfield had spent some £10,000 in getting powers to run motor 'buses in certain districts outside, but had been compelled by the local authorities to spend some £7,000 on street widening before receiving permission. In the meantime a private company was actually running 'buses without having spent any money at all upon the roads. He objected to being governed from London with regard to this matter, and hoped the Committee which had been formed by the Association to take the matter up would proceed with its work rapidly.

Councillor V. L. McEntee, M.P. (Walthamstow), objected to the view expressed in the paper that the rider should pay the whole cost of his ride. He looked upon tramways in the same way as libraries, the fire brigade, and other municipal services.

Mr. E. S. Rayner (general manager, Hull) advocated the appointment of some central authority, on the lines of the Electricity Commissioners, which would deal with the country comprehensively, and make the best use of the various means of transport now existing. In that way they would not be handicapped, as was the case now, with artificial boundaries, and it would then be possible to make the fullest use of existing facilities and so avoid useless and wasteful competition.

Councillor J. G. Frazer (Dundee) disagreed with the view expressed by the representative from Walthamstow. Tramways must be revenue-producing, and must not be allowed to come on the rates.

Alderman F. Smith (Liverpool) opposed the view that a body similar to the Electricity Commissioners should be appointed for dealing with transport problems, and objected to municipalities going outside their own boundaries.

Mr. W. Murray (general manager, Walthamstow) said that credit was not given to tramways for the many indirect benefits which they conferred upon a town. For instance, land values immediately increased. He regarded tramways as second only to sanitation in assisting in the conservation and improvement of public health. Whilst a financial profit should be made if possible, that was not everything.

Councillor D. W. Beaton (convener, Aberdeen) said that any municipal transport service must be as good as that given by private companies. He agreed with the principle that the rider should pay for his ride. The general policy in Scotland was to charge such fares as would enable them to have a renewals fund and also a reserve fund.

Alderman Clark, in the course of a brief reply, pointed out that the question of motor 'bus competition was being dealt with by a sub-committee of the Association and of the Association of Municipal Corporations, and he was very hopeful that some direct action would be taken with regard to legislation concerning this matter. He would not like to see a body such as the Electricity Commissioners appointed to deal with transport problems. The local authorities were at present smarting under the costs that the Electricity Commissioners were able to impose upon them, without the local authorities having a word to say on the matter.

### The Economy of New Car Equipment.

By R. Stuart Pilcher, Manager, Edinburgh Corporation Tramways. (*Abstract.*)

In this short paper I have confined myself to tramway motors and trucks.

In connection with the cost of maintenance of cars, there are very considerable differences between one undertaking and another. I recently sent out a list of queries to all the municipal undertakings in the country on the cost of car repairs and found that the cost per car-mile varied from the lowest, 1d. per car-mile, to 4.29d. per car-mile (one of the small systems shows a rather higher figure). Applying these figures to my own system, where we run 7¼ million miles per annum, the cost would represent a difference of £102,812 per annum.

The high costs on some systems are due entirely to the local conditions of operation, but even when allowances are made for heavy gradients or large double bogie cars, there is such a difference in the cost as to warrant investigation.

After a visit to the Glasgow workshops last year I was able to introduce a system of piece-work for coach builders and coach painters on my own system, which has worked out to the advantage of both the Corporation and the employés, with a resultant reduction in operating costs.

In carrying out the electrification of the Edinburgh tramway system I have had a unique opportunity of putting into practice some of the latest developments and improvements in electric car equipments, and alongside of the modern equipments introduced I have had the opportunity of making a useful comparison with the older types of equipments in use on the Leith system, which are common throughout the country. The old and new equipments are running together under the same conditions. The motors used on the Leith system are the G. E. 54 type, 25 h.p., and the Brush 1002 B., 28 h.p. The trucks are of the Brill 21 E. type and the Brush type—both types having a 6-ft. wheel base.

We have been operating the new light-weight equipments for 18 months, and therefore have a definite knowledge of their performance. It would not be advisable to make drastic reductions in the weight of the truck and motors without a corresponding reduction in the weight of the car body, as the centre of gravity would be considerably raised; what we have done on the light-weight cars is to effect a general reduction in weight over all parts of the car. The total reduction is from 11 tons 2 cwt. to 9 tons 9 cwt.; while the truck and motors have been reduced 11 cwt., the body and top deck have been reduced by 22 cwt., and when it is considered that the total height has been reduced 4 in., the centre of gravity is not affected adversely. I have had a car suspended by cranes, and have found out the exact balancing point. The light car has a centre of gravity 4 ft. 11¼ in. from the rail level, and the heavier car 5 ft. ¼in., so that an improvement has been

made. The tipping angle is 25 degrees. The total weight reduction for similar types of cars is from 456 lb. to 354 lb. per passenger seat, or 22 per cent.

The motors are of the box frame inter-pole type, weight 14 cwt. 3 qr., each complete with gear and gear case, and give double the horse-power of the old ones weighing 15 cwt. 2 qr. The large reduction in dimensions and weight of motors per horse-power is due to the provision of highly efficient fan cooling and the use of very powerful inter-poles. These factors allow of a large increase in output at a much lower temperature rise than has ever been obtained with the older designs.

The average temperature rise of the light-weight motor after 16 hours' running is 87 deg. F., against 121 deg. F. on the older motors.

| | Old type 25 h.p. split frame. | | | New type 50 h.p. box frame. | | |
|---|---|---|---|---|---|---|
| | Cwt. | qr. | lb. | Cwt. | qr. | lb. |
| Weight of armature ... | 4 | 2 | 0 | 3 | 3 | 0 |
| Weight of gear case ... | 1 | 1 | 10 | 1 | 0 | 0 |
| Weight of motor (complete with gear case)... | 16 | 3 | 10 | 15 | 3 | 0 |
| Weight per horse-power | 75½ lb. | | | 35 lb. | | |
| Gear ratio ... ... | 4¾ to 1 | | | 4¼ to 1 | | |
| Speed on level ... ... | 650 r.p.m. | | | 850 r.p.m. | | |
| Energy consumption (kWh per car-mile) ... | 1.24 | | | 1.18 | | |

I think it is quite clear that if new equipments are purchased it is possible to obtain greater speed and smoother running at less cost. Some of the chief items on which economy may be expected are as follows:—

ANNUAL UPKEEP ON MOTORS AND TRUCKS, PER CAR.

| | Old type. £ s. d. | New type. £ s. d. |
|---|---|---|
| Lubricating oil ... ... ... | 1 13 6 | 0 16 9 |
| Lubricating (wages) ... ... | 1 0 0 | 0 15 6 |
| Overhauling armature bearings ... (Labour and material) ... ... | 5 5 4 (On 6 months' basis) | 1 15 1 (On 3 years' basis) |
| Armature repairs (labour and material) ... ... ... ... | 3 7 3 | 1 13 9 |
| Energy consumption, 44,051 car-miles ... ... ... ... | 17 4 0 | 16 7 0 |
| Upkeep on trucks (reflanging of tyres) ... ... ... ... | 8 9 10 | None |
| Total ... ... ... ... | £36 19 11 | £21 8 1 |

Saving per car per annum = £15 11s. 10d.

This short summary is not considered complete. In addition to providing machines of double the capacity, the introduction of new equipments would reduce the maintenance of the permanent way; the introduction of new trucks with longer wheel bases would lengthen the life of the tires by reducing the wear on the wheel flanges. The introduction of long-wheel-base trucks would tend to reduce the galloping action of the cars, and so lengthen the life of the car bodies; but the greatest advantage is obtained by the more rapid acceleration of the motors and the extra capacity of the motors, which can be forced on occasions without overheating and without injury. That seven new cars will do the work of eight cars of the older type we have proved in practice by a saving in rolling stock of 12½ per cent.; there is also a saving in drivers' and conductors' wages of £681 per annum for each car saved, or 0.7d. per car-mile on the whole system.

If we take the actual saving in motors and trucks plus this saving, it is equal to £144 1s. 9d. per car per annum, or 0.78d. per car-mile.

All the modern under-carriages of the single-truck type provide for either a radial section or a displacement of the wheels out of alignment when negotiating curves. The single trucks which we have been operating are all of the swing link or pendulum type, 8 ft. 6 in. wheel base, fitted with 25-in. wheels. On examination of the wheels after 18 months we find them wearing very well. There are no disadvantages in operation; the flanges of the wheels are not unduly worn, nor is there any tendency for the flange to wear to the centre of the tire, as is common on most single trucks. The wheels have every appearance of giving as good a life as the larger wheel; the tires have the appearance of being able to wear out without being turned up to provide a new flange.

If trucks can be obtained which reduce the wheel flange wear to such an extent as will completely wear out the tire and also correspondingly reduce the rail wear on curves, it means a considerable economy.

The question of obtaining a more resilient car is being studied in Edinburgh, and tests are being carried out with special rubber-packed wheels. Between the tire and the centre there has been inserted a ring of rubber 3½ in. by 1 in., provision being made for bonding the tyre and centre together for electrical purposes. The rubber tire is pressed on to a steel ring, which in turn is pressed on the wheel centre; the tire rests on the soft rubber, insuring a certain amount of resiliency. We have found so far that the rubber will stand up to the work, but it has not been long enough in service for me to be able to express any definite opinion upon it.

It is perhaps difficult, and sometimes impracticable, to adopt a "scrapping" policy, but there should be no hesitation in laying out capital if, by so doing, the maintenance charges can be reduced.

When it was urged by me that it would pay to "scrap" the cable system in order to introduce the electric system, which could be operated more cheaply, there was a section of the community in Edinburgh that said: "Wait for a few years and save the capital expenditure"; yet, in the first year of electric operation, the working expenses have been reduced from 16.77d. to 13.18d. per car-mile, a difference of 3.59d., equal to an annual saving of £112,187 on the complete system.

In my opinion an engineer is justified in recommending the supersession of old plant by new if by adopting that course he can effect such economies as will meet any annual charges in respect of the displaced plant, and the charges consequential upon the new plant (including a rate for wear and tear sufficient to liquidate the capital cost during its useful life), and show a resulting commercial profit. If we take the figures which I have given for the saving on new equipments—and I think they are conservative figures—a saving of 0.78d. per car-mile, and apply it to the average system, it would represent on an average annual mileage of 44,051 miles per car, approximately £144 per car per annum. If this sum is capitalised at 4½ per cent. interest on a 20 years' life it represents a capital of £1,515, which is more than sufficient to purchase a complete new car equipment with all the other advantages of up-to-date rolling stock.

On occasions when I have advocated a scrapping policy I have been told: "Oh yes! but we are too poor; we have not got any money for new equipments." In my view these are the very systems which should adopt this progressive policy. If results can be realised on other tramway systems, as we have proved on the Edinburgh system, it may be an economical policy "to spend money in order to save money."

An appendix gives the cost of car repairs on 61 undertakings, the average working out at 2.49d. per car-mile.

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DISCUSSION.

Mr. A. L. C. FELL (London County Council) took exception to the publication of the appendix showing the cost of car repairs. The average committee-man would take these figures as the average, and although the actual names of the undertakings were not mentioned it was not difficult to recognise them. There were, however, several facts to be taken into account in considering this schedule. For instance, in the case of Glasgow, the figure was for mechanical repairs only, and not for both mechanical and electrical repairs. On the other hand, the figure for the London County Council tramways was considerably less now than was stated in the appendix. In 1921-22, to which year the figures related, most undertakings were struggling to get over the arrears of the war, and the London County Council figure for repairs had been reduced since then by at least 33 per cent. Another important point was that in London the cost of labour was much higher than in the Provinces. Therefore a schedule such as this was rather misleading, and without knowing the special circumstances in each case it was not possible to compare one town with another. As regarded the rest of the paper, he was mainly in agreement. It was a most excellent thing to cut down weight; he had recently installed larger motors weighing 34.2 lb. per h.p., compared with 55.9 lb. per h.p. for the older motors, and that made a considerable saving. The general question of replacing motors on old tramcars was a matter which required to be approached with considerable caution. He was installing new motors on the best of his cars at a cost of £800 each, but the cars only cost £950 each originally, and therefore the question whether it would be cheaper to have new complete cars must be considered. In some cases it might be that the greater part of the life of the old car bodies had gone, and by putting new motors on them there was a danger of finding themselves with new and fashionable motors and no bodies worth speaking of. With regard to the centre of gravity, cars should be loaded to the equivalent of the passenger loading, as only in that way could it be ascertained, under test, what the car would do.

Mr. H. P. STOKES (manager, Plymouth) said the question of scrapping cars and equipment was a very serious one for old undertakings. In Plymouth they took over two companies and had to pay a high price for obsolete equipment, so that they were saddled with an abnormal capital cost to begin with, and yet had to renew practically the whole of the rolling stock and permanent way. He had just ordered 20 new cars which weighed 306 lb. per passenger seat for the open-top type, as against 441 lb. in the case of the older cars. The new type of covered top-deck cars only weighed 365 lb. per passenger seat. In the case of four-wheel trucks he could show plenty of instances of the check rail being chewed off as fast as it was put on, through the use of pendulum gears and swinging links, and he felt that their salvation would be in the adoption of equal-wheel bogie trucks with light four-motor equipments and distributing the weight as far as possible.

Mr. R. F. WILKINSON (manager, Bradford) said that when one saw vehicles on the road of a fairly light character, carrying large numbers of people, it made one wonder why the tramcar was so heavy, seeing that it did not have anything

like the vibration which these other vehicles did, although they travelled at higher speeds. The real point was that the load was better distributed in the ordinary road vehicle, and there was not that swaying that there was with the tramcar. Since tramcars were first put on the road they had been strengthened here and stiffened there until they had arrived at the present heavy cars. At the same time, the ordinary process of evolution must come into play, and it was only after some 10 years' experience with the lighter cars adopted by Mr. Pilcher that they would be able to tell exactly how they stood up to their work. These lighter equipments also meant that the body must be lightened in order to keep the centre of gravity low. In Bradford the gauge was 4 ft., and in Halifax it was 3 ft. 6 in., and to raise the centre of gravity one inch in such towns was a very dangerous proceeding. He had had several cars blown over in Bradford due to the side pressure of wind, owing to the 4 ft. gauge. An ordinary road vehicle was not so liable to be blown over because of the wider track as compared with a tramcar, and it was far more flexible.

Councillor J. C. MORRIS MANCOR (convener, Edinburgh) said that the results obtained by Mr. Pilcher at Edinburgh had fully justified the Committee's confidence in him when he first put his proposals forward.

Mr. H. MATTINSON (general manager, Manchester) urged tramway committee-men to listen sympathetically to proposals by their managers when they were recommending the scrapping of plant. No manager would recommend such a course unless he were satisfied that it was necessary, but there was a British prejudice against scrapping plant largely, he thought, because the equipments now in use, although old, were so good mechanically that people were loath to give them up.

Mr. W. M. MILNES (general manager, Wigan) said the figures for repairs in the appendix to the paper, relating to Wigan, were much higher than was the case now. There were many authorities, like Wigan, which could not at present afford to re-equip their cars.

Mr. E. S. RAYNER (general manager, Hull) thought it was self-evident that if they were going to fight motor 'bus competition, the tramways must give equally good service to the public. The services must be speeded up, because they could not ask the public to use tramcars if the cars did not get the public from point to point at the same speed as 'buses. To do this, undoubtedly some of the old equipments must go. Further, the authorities must be persuaded to increase the speeds at present allowed. It was an anomaly to have a vehicle which was rated on the top notch at 20 to 22 miles an hour, and then to have a speed allowed in the city of 8 to 12 miles an hour. Last year he had mentioned a tramcar with a worm drive which he was then designing; it was running very well. He got very fine acceleration without jolting, and the car was always catching the one in front. He gained something like three minutes in a two-mile run, and carried more passengers than the ordinary tramcar.

Mr. PILCHER, replying, said that he would not have published the schedule complained of by Mr. Fell if he had thought it would do any harm. The names of the towns were not mentioned, however, and the figures were all for the same year, so that they were comparable. The Americans, during the war, discovered that if weights could be reduced working expenses could be reduced. He had read that a company in Cincinnati was going to scrap all its equipments, and hoped to save from 15 to 20 per cent. by so doing. He had brought the matter forward to meet motor 'bus competition, because he felt that unless working expenses were reduced many tramway undertakings would go out of existence. The Board of Trade had allowed him a limit of 20 miles an hour on some routes, and he had been told that that could be liberally interpreted. It was up to the tramway authorities to increase their speeds so that they could compete with the 'buses.

### Annual Report.

THE annual report of the Council for the past year shows that the membership now comprises 96 local authorities, 96 general managers, and 19 associate members; 8 undertakings remain outside the Association. The accounts show receipts £3,567, and expenses £3,593.

Special attention has been given to the subject of unfair competition, and a joint committee of members of the Association and of the Association of Municipal Corporations is examining the position. The question of "unemployment insurance by industries" has been considered, but the scheme is not practicable in connection with the tramway industry. The Council has investigated the bearing of the Road Fund on the cost of upkeep of permanent way under modern conditions, and concludes that it would be impolitic to pursue the matter under existing circumstances. The regulation of traffic at stopping-places has been considered with special reference to accidents due to vehicles passing on the near side of stationary tramcars and the latter has been referred to a sub-committee. The International Union of Tramways and Light Railways has been invited to hold its next convention in this country in 1924. The constitution of the Council is being considered by a committee in the light of recommendations received from member associations.

Appendices to the report give particulars of the work of the National Joint Industrial Council, the working results of municipal tramway undertakings, accidents caused by vehicles, and the accounts of the Association.

## BROOKHIRST A.C. MOTOR-STARTING EQUIPMENT.

WE mentioned in a recent issue that Brookhirst Switchgear, Ltd., had opened a showroom at Australia House, Strand, W.C.2, for the display of motor-starting equipment. In this apartment the firm shows several examples of its a.c. and d.c. gear connected up for operation and demonstration. The d.c. apparatus exhibited has already been described in our columns,* but the a.c. equipment is of new design possessing many distinctive features.

In general it may be said that the principal aim of the manufacturers has been to group in one self-contained assembly the whole of the equipment necessary for the control of a motor. Such points as the dissipation of heat have been carefully attended to, and the question of interconnection, which presents some difficulty in the grouping of the components, has been solved by the provision of a special connection chamber in the rear of each pillar. In this chamber, as will be seen from fig. 1, the connections to the incoming cables are made by means of rigid rods fixed into a bar at the top of the chamber, the same arrangement being adopted for the connection of the gear to the outgoing leads. Doors are provided at the rear of the pillar rendering the connections easily accessible. Safety is assured by an interlocking arrangement which, in one movement, secures all covers and doors. The device is seen in fig. 2, which illustrates a rotor-starting pillar, and it will be observed that the movement of the gate on the left-hand side of the illustration causes lugs to engage with the removable parts—the resistance cover, the switch tank, and the top cover. The gate is locked by the operation of the isolating switch handle to the right of the pillar, and until the isolator is "off" the gate cannot be swung clear of the covers and tank. This isolating switch is not used to open the circuit while the circuit-breaker is in the "on" position. A pair of auxiliary contacts upon the end of the isolator operating bar is arranged to open and trip the circuit breaker before the gear is finally disconnected by the isolator. The external connections are taken to and from connector boxes mounted at the sides of the pillar, an arrangement rendered possible by the employment of rigid connections from the boxes to the starting gear. The glands are varied to suit the type of cable employed.

The main components of the equipment, the starter and the circuit breaker, are combined in one "unit" in the oil tank. These may be of four types, *viz.*, "straight-on," star-delta, auto-transformer, or rotor. Fig. 3 is typical of the whole, and shows a star-delta starter. Operations are carried out by means of a single handle which rotates the main operating shaft through a ratchet movement. The mechanism is shown in fig. 4 (longitudinal section), and fig. 5 (transverse section). The movable contacts are copper wedges mounted on cross arms at the base of vertical steel rods. The fixed contacts consist of copper blocks attached to copper laminations and backed with flat phosphor bronze or (in the larger sizes) steel springs. Each pair of vertical steel rods is connected between two steel plates which form a lever, and this is mounted on a shaft. At the upper end of these steel-plate levers is fixed a roller with which cams on the main operating shaft engage. Consequently, as the main operating shaft is rotated these cams, which are arranged to act in correct sequence, come into contact with the rollers raising the levers and through them the vertical rods bringing the movable contacts up into the fixed contacts. The switch nearest the handle is held in position mechanically, but in case of an excessive overload during starting the "trigger" holding it down is released by the upward thrust of an overload device and the switch is tripped. The starting handle is connected to the operating shaft through a pair of spur gears, and a ratchet device prevents the gear from being operated too quickly. The first movement of the handle closes the circuit breaker, and then the "star" switch is closed. The next three movements are merely to "mark time" until the current rush caused by the previous movement has had time to fall, and then the delta-connection switch is closed, while immediately before contact is made the star circuit is broken. The opening of the star connection switch is effected in a positive manner by means of a projection on the cam, which strikes the end of the steel plate lever, so that if by

* ELECTRICAL REVIEW, Jan. 27th and April 28th, 1922.

any chance the star switch has welded up, the delta switch cannot be closed so as to cause a "dead" short-circuit. When the delta switch is closed, an additional cam at the extreme end of the operating shaft raises the cores of the overload release solenoids into the running position. This overload release

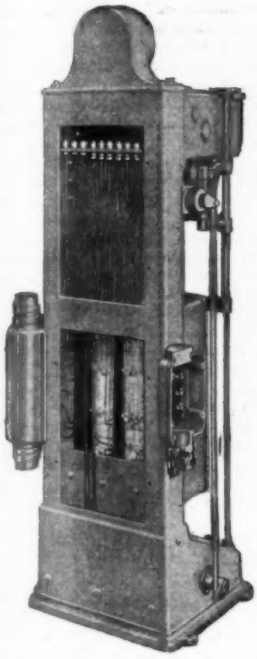

Fig. 1.—Rotor-starting Pillar; Rear View Showing Connections.

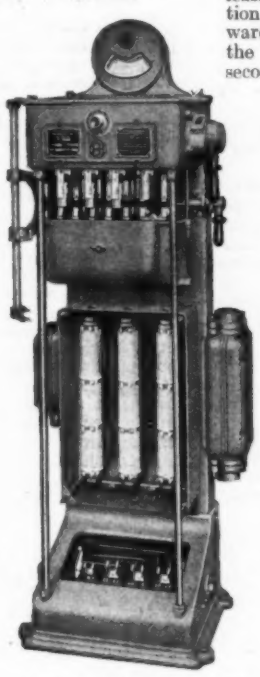

Fig. 2.—Rotor-starting Pillar; Front View.

device is seen at the left-hand side of fig. 5, and is fixed at the front of the pillar outside the oil tank. It is fitted with a special "restraining" device which prevents it from tripping due to the normal starting currents which are naturally much higher than the running loads. By means of this it is possible still to protect the motor, as if it is set for a certain running overload, it will operate at a certain point above this while starting, and, as mentioned above, the running adjustment is the final starting movement. This is more satisfactory than the usual holding-down device as it is automatic and easily adjusted by means of a stop on the central pillar behind a scale, seen in fig. 3. The no-voltage release is also shown in fig. 5. Fitted to the starting handle is an indicating device showing whether the mechanism is "off" or "on." When the starting handle is moved upwards into the operating position, a cam moves a spring plunger which bears against the vertical arm of a bell-crank lever. The end of the horizontal arm of this lever is situated above the end of a lever connected with the tripping shaft, and extending over the no-voltage release coil. If in any intermediate stage of the starting operation the handle is released, it will fall sideways and downwards, allowing the spring plunger to move to the right, and the horizontal arm of the bell-crank lever to fall on to the second lever, thus tripping the circuit breaker. It is then compulsory upon the operator to return to the "off" position and re-commence the sequence. In the final position, however, a pin upon the gear wheel on the handle shaft comes into position and holds the vertical arm of the bell-crank lever clear of the tripping lever.

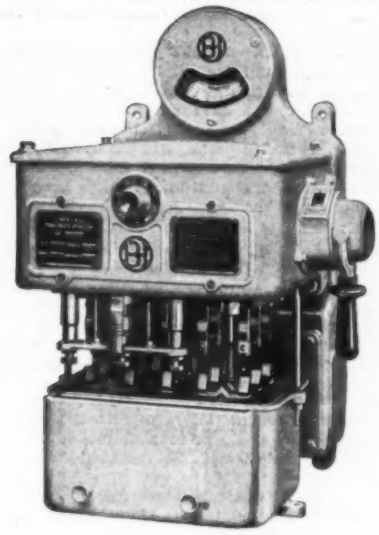

Fig. 3.—Oil-immersed Star-Delta Starter.

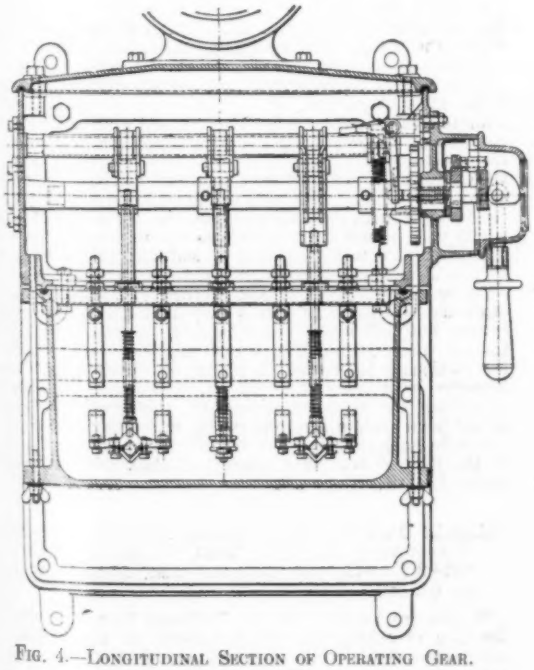

Fig. 4.—Longitudinal Section of Operating Gear.

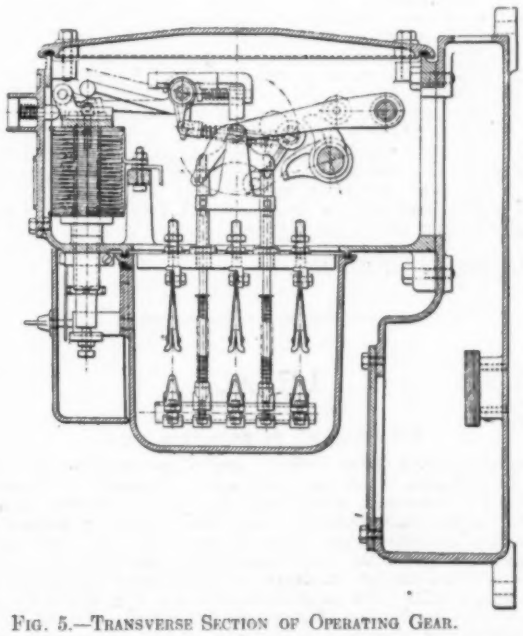

Fig. 5.—Transverse Section of Operating Gear.

The equipment is made to deal with four ranges of voltage (100-125, 200-250, 400-500, and 550-650). In the lowest-voltage range the star-delta and auto-transformer starters are made for motors up to 16-20 b.h.p.; rotor starters for 41-50 b.h.p. (260 rotor amp.) motors with normal rotor currents, and for 16-20 (141-160 rotor amp.) motors with high rotor currents; and "straight-on" starters for 11-12 b.h.p. The equivalent maxima for the highest voltage range are 101-125 b.h.p.; 201-225 and 101-125 b.h.p.; and 31-35 b.h.p.

## CORRESPONDENCE.

*Letters received by us* **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Power-Factor Indicators.

In your issue of August 3rd, Mr. Ockenden describes certain power-factor indicators recently placed on the market by Messrs. Everett, Edgcumbe & Co.

It is more particularly with regard to the unbalanced-load power-factor indicators that I would like to address a few remarks to you.

Mr. Ockenden claims certain points of novelty of construction in the instruments described, and to the casual reader it would appear that he has either ignored or is entirely ignorant of the work which I have done in conjunction with Messrs. Nalder Bros. & Thompson, Ltd., and also that of Dr. Gifford in conjunction with the same firm on unbalanced-load power-factor indicators, in both of which constructions no claims are required, and which instruments have been on the market for a number of years.

As regards the details given of the instrument described, it would appear to follow with extraordinary closeness the construction which I patented in conjunction with Messrs. Nalder Bros. & Thompson, Ltd., Patent No. 162,471, of 1920, also in the Patent of Addition No. 188,532, of 1921.

In these patent specifications I have particularly described the novel method of building up the moving system of several magnetic elements fixed one above the other on the same spindle.

The iron armatures are specified to be of a special shape and mechanically set at 120 geometrical degrees from one another round the spindle in instruments intended for use on 3-phase circuits (and 90 deg. in the case of single- and two-phase instruments).

The magnetisation of each armature, or pair of armatures, as the case may be, is obtained by means of individual pressure coils placed one above the other along the spindle of the moving system, which "magnetising coils" are particularly described as carrying currents out of phase with one another, usually differing by 120 deg. for 3-phase working, and 90 deg. for single- and two-phase.

More details are given in my patent specifications which I need not repeat here.

It will be seen, therefore, that so far as the moving system is concerned, Mr. Ockenden in principle has entirely adopted my construction. The only difference would be found in the arrangement of the current "field" coils, and here again Mr. Ockenden uses the old out-of-date Conrad construction with all its disadvantages of drag torque and load error.

Full details of Dr. Gifford's induction dynamometer instrument have been published in the technical Press, as well as in various catalogues and brochures issued by the makers. The same can also be said respecting my instrument, and for Mr. Ockenden to make claims for originality in connection with unbalanced-load indicators, at this date, in which he claims novelty of construction for an instrument in which the pointer is free to rotate continuously in either one direction or the other, is, to say the least, ignoring facts, which is not very excusable in one who is supposed to be conversant with the matter on which he is writing.

I should have written previously, but I was abroad on my holiday when the article appeared.

**C. L. Lipman.**

London, *August 31st*, 1923.

## LEGAL.

### Infringements of Insurance Acts.

CONTRAVENTIONS of the National Health Insurance Act and the Unemployment Insurance Act were admitted by Messrs. Fraser & Robertson, electricians, 23 and 24, Church Lane, Edinburgh, at the Sheriff's Court on August 31st. A partner of the firm admitted that between December 4th, 1920, and December 30th, 1922, they deducted 5d. per week from the wages of an employé contrary to the National Health Insurance Act, 1913. The prosecutor explained that the Act provided that in the case of employed contributors of either sex, of the age of 18 years and upwards, whose remuneration did not include the provision of board and lodging by their employer, and did not exceed 3s. per working day, the employer was liable to pay the whole contribution of 10d. per week for men and 9d. for women. It was also stated that the firm failed between July 8th and December 30th, 1922, to affix stamps in respect of the same employé in payment of contributions at the rate of 1s. 7d. and 9d. per week for each week during the period in question. The Sheriff imposed a fine of £2 for the first offence and £3 for the second.

## REVIEWS.

*Dictionary of Applied Physics.* Vol. V, Aeronautics—Metallurgy. Edited by Sir R. GLAZEBROOK. Pp. viii+592. Illustrated. **London: Macmillan & Co., Ltd. Price 63s.**

This is the fifth and last volume of "a dictionary of applied physics," and fitly completes what is certainly the result of a very fine piece of organised team-work. This dictionary is the achievement of a constellation of eminent workers, embracing almost every name well known in physical science, brought together under the editorship of Sir Richard Glazebrook. The cost is necessarily considerable. Three guineas is no small sum to pay for each volume; but when they are volumes of a work intended to bring up to date information concerning branches of human knowledge that are in a state of rapid development, the wonder is that it can be so well done at so little cost.

In fixing upon the distribution of subject-matter between the several volumes, it was doubtless an object in the mind of the editor to spare the pocket of persons whose interests were confined to particular branches of physics. In this last volume, for example, though aeronautics lays almost every division of science under contribution, it is specially dependent on that of metallurgy. Without metal we might possibly learn to glide, but we could hardly hope to fly; since the magnitude of our machines would be limited to the strength of our materials, as the size of birds is limited by the strength of the tissues they are able to grow; and at the present moment current improvements in aircraft construction depend very much on the exceptional properties of the new alloys the science of metallurgy is placing in the hands of engineers to employ. So these two subjects are happily combined in one volume.

The articles on "Iron-carbon Alloys" and on "Defects and Failures of Metals," by D. Hanson, D.Sc.; on "Manganese Steel," by Sir Robert H. Hadfield, Bart., D.Sc., D.Met., M.Inst.C.E., F.R.S.; on "Special Steels," by William Herbert, D.Met., F.Inst.P.; on "Alloys," by John L. Haughton, D.Sc., F.Inst.P.; on "Refractories," by Walter James Rees, B.Sc. (Tech.), F.I.C.; and by E. A. Coad-Pryor, B.A.; are of general interest; so are the several articles on "Special Alloys and Other Metals," by Walter Rosenhain, B.A., D.Sc., F.Inst.P., F.R.S. The articles relating to aeronautics, which form the first part of the volume, having a division of the work to themselves, are naturally of a more special character, but one is impressed by the enormous amount of work that has been done, and is being done, in this subject. With regard to the helicopter, no really reliable theory has yet been established, so that here in particular there is a large field yet awaiting research. The last pages of the volume are occupied by a general index of all five volumes, the use of which will save much turning over of leaves in many cases where the inquirer is in search of one of the important articles that constitute the work. This volume is, therefore, specially useful.

If the total cost of the whole work places the complete dictionary beyond the reach of many private workers, this makes it the more important that all libraries should be equipped with all five volumes. Librarians are not always very efficient curators of knowledge; they, or committees responsible, are too apt to confine their duties to the custody of books; and with regard to scientific knowledge they are often incompetent to do more. As a result it is not unusual to find their shelves encumbered with obsolete treatises and superseded text-books which may be not only worthless, but misleading and a positive hindrance to the pursuit of learning. More room could be found in most libraries if only the shelves allotted to science were properly supervised and weeded out. Sometimes from discarded books a little money may be realised, not much, of course, but sufficient perhaps to make a modest contribution towards the expense of new and useful scientific works like the dictionary before us. A library in which science has not hitherto been represented at all, would not be completely furnished by the acquisition of this dictionary, but it would have made a good beginning, and if it never acquired a scientific book of less value for the money it costs, it will be in the way to become a miracle of cheapness and efficiency among libraries.

*Industrial Mathematics Practically Applied.* By PAUL V. FARNSWORTH. London: Scott, Greenwood & Son. Pp. viii+272, with 250 diagrams and illustrations. Price 8s. 6d. net.

It was, we believe, the late Professor Perry who conceived the idea of taking the broad subject of mathematics and eliminating from it all that was not of immediate practical value, to produce a subject specially suitable for the use of engineers. In the curriculum of the Board of Education the subject was first called Practical Mathematics, and under this title or others, such as Mathematics for Engineers, many books embodying the ideas of Prof. Perry have been published. The book under review is an American attempt to deal with an admittedly difficult subject, "Industrial Mathematics" in this case meaning almost exclusively Engineering Mathematics. We do not know whether the standard of intellect of the average engineering apprentice is lower than that of the apprentices

to other crafts, but it is a lamentable fact that in the majority of engineering works the apprentices often reveal complete ignorance of the methods of performing even the most simple calculations. These apprentices in due course become fitters, machine operators, and possibly foremen, and the same inability to carry out the easy calculations which their duties so frequently demand still remains. Apparently the same state of affairs exists in the United States, for the author, writing after twelve years' experience as a supervisor of apprentices and an instructor in evening classes at technical schools, recognises the difficulties which beset young engineers in their endeavours to apply their knowledge of mathematics to practical problems.

He has given us a book in which, after a brief survey in the first few pages of the most elementary principles of arithmetic, he deals with such of the elementary principles of algebra and trigonometry as are utilised in ordinary engineering calculations, and what is probably of even greater value, he not only illustrates these principles, but even sets them forth by reference to practical engineering problems. From the very outset, even in the preliminary revision to which reference has already been made, great care has been taken to bring in actual practical calculations the same as might be met with in the engineering workshop. There are more than 1,000 exercises in the book and these include such calculations as are required in the setting of machine tools, the arrangement of tooth gearing, determination of the strength of materials, while quite a number are based upon electrical problems. In this way the interest of the student is awakened at the outset and is sustained throughout, while the numerical answers which are given in every case enable him to determine immediately what progress he is making in his studies. Of particular interest is that section of the book dealing with costing and the drawing-up of "operating index sheets" or, as they are usually termed in this country, "progress charts." Another valuable section is that dealing with the preparation of graphical charts. These last three sections are, we believe, capable of being considerably extended and doubtless, in the hands of a careful teacher, they would be.

As already noted, the book is of American origin, and that accounts for the fact that all money calculations are in dollars and cents, while for weights we have 1 cwt. = 100 lb., which, as far as British engineers are concerned, is truer euphonically than it is in fact. To the same cause we must ascribe certain Americanisms in the spelling. These are rather matters for regret, as it does not give the student an opportunity of working in the units which he must employ in his daily work, and if a British edition of this work were contemplated it would certainly be of great value if the necessary alterations could be made. We can, however, most heartily recommend the book to teachers of engineering mathematics, who will be able to make the necessary corrections themselves, and also to the student who is compelled to get along as well as he can without the aid of a teacher. It is certainly one of the best elementary books on engineering mathematics that we have seen, and one a study of which should assist the engineer to overcome the difficulties he may have experienced in making even the simplest calculations.

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*The Theory of Prime Movers.* By C. A. MIDDLETON SMITH, M.Sc. (Eng.), M.I.Mech.E., and A. G. WARREN, B.Sc. (Eng.) A.M.I.E.E. London: Constable & Co., Ltd. Pp. xi+299, with 246 diagrams. Price 22s. 6d. net.

The candidate for the examination in heat engines for the degree of Bachelor of Science (Engineering) of our modern universities and for the similar examination for associate membership of the leading technical institutions, such as the Electrical and Civil Engineers, often finds a considerable difficulty in mastering the theory of that subject although he may be very well versed in the more practical part, such as the care and operation of heat engines. It is not only candidates for these and kindred examinations who find a difficulty in connecting the two sides of the subject—theory and practice—together, and the authors of this book in publishing the notes of lectures delivered by them to university students should appeal to a wider public than that represented by candidates for engineering examinations. Frankly, there is always a difficulty in bridging the gulf which exists between the laws of physics and engineering science, and it is only by continued reference to actual practical engineering problems that the theory of heat engines can become, to the majority of students, a subject which they are prepared to study with interest and pleasure. In using the word student in this connection we do not mean only the youth at the university or the technical college, but the engineer who is desirous of obtaining a greater knowledge of the theoretical side of his profession and who wishes to obtain membership of its recognised Institutions.

In this book such students will find the physical laws underlying the theories of the different kinds of heat engines set forth in as simple language as possible, while throughout the text a number of numerical exercises are interposed, which serve to indicate the practical application of the theory being studied. It is to be regretted that the authors did not extend this feature by including a set of examples at the end of each chapter, since nothing will rivet the theory of a subject in the mind so much as a number of calculations in which that theory is put to practical use. It may be that the authors are following the syllabus that is laid down for the examinations that we have already referred to, but in this book, as in quite a number of others on heat engines that have come to our notice during the past few years, there is far too much attention paid to the problems which are peculiar to the reciprocating steam engine to the exclusion of those dealing with more modern forms of prime movers. Except for the locomotive engineer and the marine engineer, and in a very limited sense, the mill engineer, the reciprocating steam engine is now almost obsolete, and such subjects as valve diagrams, reversing mechanisms, &c., have, therefore, but little more than academic interest. On the other hand, the chapter on air compressors and refrigerators, while not literally justifiable in a book on "Prime Movers," is welcome, because it deals with a part of the subject of heat engines which is too frequently neglected. The text has been very carefully written and the diagrams are both numerous and well drawn, but we should have liked to have seen brief underlines accompanying each of the diagrams, as where they are divorced from the text, as is frequently unavoidable in setting up a book such as this, it makes reference to any particular part of the subject a matter of some difficulty. With these minor reservations we have nothing but praise for this book, and we can heartily recommend it to all practical engineers (as well as to college students) who are desirous of studying the theory of heat engines with a view to passing the examinations in that subject for the associate membership of the engineering institutions or for their engineering degree.

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*Electric Motors.* By H. M. HOBART, F.A.I.E.E., M.I.E.E. Third edition. Vol. I, Direct Current; Pp. xvi+412. Vol. II, Polyphase Current; Pp. xv+384; figs. 378. London: Sir Isaac Pitman & Sons. Price per volume, 15s. net.

Reading this new edition of Mr. Hobart's work has been rather a disappointment. The explanation is found in the author's opening words: "In completely revising and rewriting this work on electric motors, some specifications of motors that have proven their good qualities by long service are retained, because these satisfactorily illustrate the details of the process of preparing designs." The result is unfortunate. In so far as theory is concerned, the retention of old material is obviously sound, provided that it has not been improved or superseded by later work; but as regards design and construction the position is quite different. The state of the art is not what it was when Mr. Hobart published his second edition. Very great progress has been made in all that relates to the manufacture of electric motors; and the many readers who have been accustomed to refer to Hobart for up-to-date information will be seriously disappointed at finding so many out-of-date designs given in the latest edition. Doubtless old machines may serve to illustrate the process of preparing designs, but will not modern machines serve the same purpose and in addition familiarise the reader with present-day practice? Could not the same argument be applied to laboratory testing? Doubtless many students are given machines 20 to 30 years old to test for characteristics, efficiency, &c., and doubtless there are many who are ready to justify this practice; but we may still ask if it is not better to give the student machines to work with which will give him a much better idea of what to expect in practice. In some places, indeed, Mr. Hobart recognises this weakness in the new edition, by emphasising that makers are not so keen now as formerly in permitting modern designs to be published; but surely this ought not to deter him from making his own designs. We are well aware of the immense labour involved in such work—are not Mr. Hobart's volumes alone evidence of this—but we are afraid this is but part of the price demanded from a widely-read author.

Let us now turn to some of the more pleasing aspects of the work. As is to be expected by those acquainted with Mr. Hobart's activities, we have some very modern information on classification, standardisation, rules, &c.—indeed, one set of definitions is headed: "A proposed list which is at present (1921) informal, but likely soon to be given a good status." We like this heading, which at once takes our minds away from technical jargon to the style of "Pickwick Papers." Then again, the author has taken great care in describing the multifarious ways of obtaining a good starting torque with the squirrel-cage rotor, though some of the methods given have scarcely got beyond the patents literature. Also modes of obtaining speed variation with the induction motor are dealt with very fully. We are glad to see that due credit is given to Hunt's work, but mention might also have been made of the comparatively recent extension of the method of phase changing employed by Creedy in his multi-speed motor. Among the commutator motors with shunt characteristic, the author seems to have overlooked the important motor developed by Schrage at the A.S.E.A. works, and built in Germany by the S.S.W., and in this country by the B.T.-H. Co.

Mr. Hobart is too well-known as a writer to need any criticism regarding ability, &c.—indeed it is because we think that the present work scarcely does him justice that we began by confessing our disappointment.

## NEW PATENTS APPLIED FOR, 1923.

**(NOT YET PUBLISHED.)**

**Compiled expressly for this journal by MESSRS. SEXTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.**

20,990. "Electric condensers." E. R. Gardner and Hawkins, Ltd. August 18th.
21,004. "Production of continuous electrical oscillations." W. Ritscher (Firm of). August 18th. (Germany, August 18th, 1922.)
21,027. "Elevator systems." W. A. Machin. August 20th.
21,032. "Indirect lighting." J. T. E. Sloan. August 20th.
21,034. "Squirrel-cage induction motors." T. F. Wall. August 20th.
21,037. "Joints for electric cables." A. M. Taylor. August 20th.
21,047. "Electric lamps." A. A. Sandbrook. August 20th.
21,049. "Variable electric condensers." F. H. Blaxfey. August 20th.
21,052. "Tube railways." J. W. Hartley and A. T. Penney. August 20th.
21,054. "Signalling systems." Western Electric Co., Ltd. August 20th. (United States, August 19th, 1922.)
21,075. "Ignition systems." A. Howard. August 20th.
21,076. "Methods of joining metals." British Thomson-Houston Co., Ltd. (General Electric Co.). August 20th.
21,090. "Rotor windings for asynchronous motors." C. Shenfer. August 20th.
21,094. "Electric heating apparatus." A. F. Berry. August 20th.
21,117. "Wireless telegraph, &c., apparatus." A. Compare. August 20th.
21,118. "Wireless telegraph, &c., apparatus." A. Compare. August 20th.
21,120. "Ignition plugs." W. O. Horsnaill. August 21st.
21,123. "Means for adjusting variable electric condensers, &c." F. H. Philpott. August 21st.
21,128. "Marine signal lights." C. G. Rask. August 21st.
21,146. "Multiple telephone, &c., terminals." E. J. Lord and T. J. Marchant. August 21st.
21,164. "Electric couplings." H. Macfarlane. August 21st.
21,174. "Wireless telegraph, &c., apparatus." L. Lévy. August 21st. (France, August 24th, 1922.)
21,176. "Means for distribution and reception of electrically-transmitted signals." E. Bertron. August 21st. (Belgium, August 28th, 1922.)
21,183. "Electron discharge devices and circuit arrangements therefor." British Thomson-Houston Co., Ltd. August 21st. (United States, October 3rd, 1922.)
21,187. "Diaphragms for telephones, &c." A. W. Stapleton. August 21st.
21,194. "Method of producing sparkless commutation in electric collector machines." U. Cantutti. August 21st.
21,195. "Apparatus for striking the arc in electric welding." Akt. Ges. Brown, Boveri et Cie. August 21st. (Germany, August 28th, 1922.)
21,198. "Reception of wireless signals, &c." C. A. Pooley. August 21st.
21,225. "Microphones." W. K. L. Dickson. August 22nd.
21,236. "Crystal detector for wireless telephony, &c." A. E. Handford. August 22nd.
21,237. "Variable and fixed condensers." G. H. Moody. August 22nd.
21,251. "Wireless control, &c." C. P. Ryan and Vickers, Ltd. August 22nd.
21,255. "Closure means for accumulators." Soc. des Accumulateurs Fixés et de Traction. August 22nd. (France, September 6th, 1922.)
21,256. "Packing-gland for accumulator terminal." Soc. des Accumulateurs Fixés et de Traction. August 22nd. (France, September 6th, 1922.)
21,257. "Terminals for accumulator plates." Soc. des Accumulateurs Fixés et de Traction. August 22nd. (France, September 5th, 1922.)
21,259. "Wireless control, &c." C. P. Ryan and Vickers, Ltd. August 22nd.
21,264. "Wireless control, &c." C. P. Ryan and Vickers, Ltd. August 22nd.
21,269. "Process for increasing life of graphite or carbon electrodes." T. Shields (Koholyt Akt. Ges.). August 22nd.
21,271. "Wireless control, &c." C. P. Ryan and Vickers, Ltd. August 22nd.
21,275. "Electric meters." Metropolitan-Vickers Electrical Co., Ltd. August 22nd. (United States, September 2nd, 1922.)
21,277. "Wireless control, &c." C. P. Ryan and Vickers, Ltd. August 22nd.
21,285. "Wireless telegraph, &c., receivers." C. G. Rope. August 22nd.
21,301. "Miners' electric lamps." G. Dienne and Soc. Anon le Gaz Pauvre. August 22nd.
21,312. "Electromagnetic firing mechanism for guns." H. G. A. Scott. August 23rd.
21,317. "Device for holding and connecting dry batteries." H. A. Yoward. August 23rd.
21,318. "Device for controlling electric currents for radio telegraphy, &c." H. A. Yoward. August 23rd.
21,325. "Electric clocks." W. C. Linfoot. August 23rd.
21,330. "Emergency brake for electric trams." W. Binney. August 23rd.
21,337. "Crystal holders for wireless receivers." H. R. A. Fenner and H. J. Orbell. August 23rd.
21,370. "Ignition distributors." H. Ford and G. H. Taylor. August 23rd.
21,372. "Electromagnetic devices." Western Electric Co., Ltd. August 23rd. (United States, September 18th, 1922.)
21,375. "Coil-winding apparatus." W. O. Heyne. August 23rd.
21,379. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). August 23rd.
21,380. "Automatic switching equipments." British Thomson-Houston Co., Ltd. August 23rd. (United States, September 15th, 1922.)
21,404. "Vibrating systems for telephony, &c." C. R. Cook. August 23rd.
21,405. "Dynamo-electric machines." W. F. Higgs. August 23rd.
21,413. "Wireless telegraph, &c., systems." Soc. Francaise Radio-Electrique. August 23rd. (France, August 24th, 1922.)
21,415. "Electric condensers." A. Preen. August 23rd.
21,417. "Rheostats for dimming vehicle head-lamps, &c." J. S. Mulock. August 23rd.
21,443. "Apparatus for thermostatic control of electric heaters, &c." G. Wilkinson. August 24th.
21,460. "Electrically-driven motor vehicles." F. H. Schroeder. August 24th.
21,474. "Employment of cathode-ray oscillographs." N. Kipping and Western Electric Co., Ltd. August 24th.
21,475. "Wire-drawing machines." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 24th.
21,490. "Electric locomotives." Akt. Ges. Brown, Boveri et Cie. August 24th. (Germany, May 22nd.)
21,498. "Resistance control apparatus." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 24th.
21,501. "Electrical heating systems." Grierson, Ltd., and R. Grierson. August 24th.
21,502. "Electrical heating systems." Grierson, Ltd., and R. Grierson. August 24th.
21,503. "Electrical heating systems." Grierson, Ltd., and R. Grierson. August 24th.
21,504. "Electrical heating systems." Grierson, Ltd., and R. Grierson. August 24th.
21,530. "Thermostatic electrical controls." Kitson Engineering Co. (London), Ltd., and W. A. McNutt. August 25th.
21,546. "Electric protective arrangements." Electrical Improvements, Ltd., L. C. Grant, and R. W. Gregory. August 25th.
21,551. "Telephone receivers." T. Thorne-Baker and W. J. Pabst. August 25th.
21,557. "Electric generator and engine starting device." L. Lanquetin. August 25th.
21,558. "Magnetic alloys for telegraphic, &c., cables." H. J. Garnett and W. S. Smith. August 25th.

## PUBLISHED SPECIFICATIONS.

**The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.**

### 1921.

21,419. "Winding, forming, and like operations in making coils for dynamo-electric machinery." B. Gill. May 11th, 1922. (201,586.)

### 1922.

2,748. "Electrodes for welding and like purposes." Whitecross Co., Ltd., H. D. Lloyd, and W. W. Wilson. February 4th, 1922. (201,673.)
3,775. "Means for protecting the joints of underground electric cables." H. Hawkins, H. J. Chaytor, and L. R. Lee. February 9th, 1922. (201,947.)
4,587. "Charging secondary batteries." E. L. Burne. February 16th, 1922. (201,950.)
6,915. "Lamps for motor cars, illuminating photographic studios, theatre spot-lights, searchlights, lighthouses, and the like." W. Fenton. March 9th, 1922. (201,956.)
9,886. "Prepayment electricity meters." F. Holden and Measurement, Ltd. April 6th, 1922. (201,972.)
10,328. "Electrical distribution boards." W. Gee. May 4th, 1922. (201,975.)
10,585. "Electric switches." J. A. Crabtree. April 13th, 1922. (201,976.)
11,409. "Illuminated signs." T. W. Arnall and A. J. Short. April 29th, 1922. (201,982.)
12,145. "Jointing of the glass protective covers of electric lamps and other apparatus to their fittings or casings." W. B. Shaw. May 1st, 1922. (201,984.)
12,152. "Electrical means for indicating, measuring, and/or recording small movements and vibrations of solid bodies." H. A. Thomas. May 1st, 1922. (201,985.)
12,407. "Sparking plugs." J. P. Shappe and C. Lansdown. May 3rd, 1922. (201,991.)
12,631. "Tubular electric lamp fittings." E. T. R. Murray. May 4th, 1922. (Addition to 173,052.) (202,000.)
12,642. "Methods of making tungsten wires." British Thomson-Houston Co., Ltd. (General Electric Co.). May 4th, 1922. (202,001.)
12,719. "Selecting devices for telephone systems." Siemens Bros. & Co., Ltd., E. A. Petithory, and J. E. Collyer. May 5th, 1922. (202,005.)
12,788. "Shades for application to or use with electric lamps requiring shades." A. N. Haworth. May 6th, 1922. (202,009.)
12,869. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 14th, 1921. (179,930.)
13,000. "Lamps for motor vehicles and the like." F. T. Brearly and H. Glover. May 9th, 1922. (202,020.)
13,095. "Electrically-operated organs." J. H. Compton. May 9th, 1922. (202,025.)
13,168. "Electric lamps suitable for use in mines and other places." H. S. Potter and M.L. Magneto Syndicate, Ltd. May 10th, 1922. (Cognate application 2,805/23.) (202,027.)
13,322. "Electrical transformers." British Electric Transformer Co., Ltd., and J. Roothaan. May 11th, 1922. (202,036.)
13,341. "Electrically-driven road vehicles." F Crawford. May 11th, 1922. (202,037.)
13,454. "Electron discharge devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). May 12th, 1922. (202,047.)
13,627. "Electric light fittings." A. Bushell. May 15th, 1922. (202,055.)
13,917. "Magneto-electric generators and the like." Evershed & Vignoles, Ltd., and G. B. Rolfe. May 17th, 1922. (202,062.)
13,925. "Electric control systems for arcing electrodes." British Thomson-Houston Co., Ltd. (General Electric Co.). May 17th, 1922. (202,063.)
14,052. "Electric accumulator batteries." Soc. des Accumulateurs Electriques Anciens Etablissements A. Dinin. July 6th, 1921. (182,770.)
14,193. "Transmission of sound by means of light waves." British Thomson-Houston Co., Ltd. May 20th, 1921. (180,338.)
14,212. "Connecting and supporting devices for electric fixtures." Benjamin Electric, Ltd. August 22nd, 1921. (185,090.)
14,674. "Electric incandescent and like lamps, holders or fittings." W. Broady. May 25th, 1922. (202,086.)
16,117. "Rheostats for controlling the filaments of vacuum tubes." A. P. Welch. June 10th, 1922. (202,102.)
16,477. "Electric wave filters." Western Electric Co., Ltd. (Western Electric Inc.). June 14th, 1922. (202,105.)
16,827. "Receiving arrangements for wireless telegraphy and telephony." L. G. Preston and J. C. W. Drabble. June 17th, 1922. (202,111.)
17,009. "Electrical apparatus for use in high-frequency circuits." A. H. S. MacCallum. June 20th, 1922. (202,115.)
17,166. "Electric ship propulsion systems." British Thomson-Houston Co., Ltd., and D. E. Jewitt. June 21st, 1922. (202,117.)
18,106. "Electric furnaces." P. R. Kuenrich. July 1st, 1922. (202,127.)
20,963. "Sparking plugs." L. Korczynski. August 1st, 1922. (Convention date not granted.) (184,180.)
21,837. "Electrical storage batteries." Chloride Electrical Storage Co., Ltd. (B. Ford). August 10th, 1922. (202,163.)
21,927. "Electric lighting systems for motor vehicles and more especially for motor-cycles." K. Knapp and F. Neumeyer Akt. Ges. August 15th, 1921. (184,486.)
23,409. "Electric fusible cut-outs." A. H. Railing, C. C. Garrard, and A. F. Searle. August 29th, 1922. (202,175.)
24,401. "Electric motor-driven jet interrupter." Reiniger, Gebbert and Schall Akt. Ges. January 12th, 1922. (191,701.)
25,718. "Electric switches." J. Lucas, Ltd., O. Lucas, and W. H. Eggington. September 22nd, 1922. (202,192.)
27,274. "Chucks for use in winding wire on the cores of electromagnets." C. Brandes Inc. August 11th, 1922. (202,198.)
30,150. "Combined internal-combustion and electric propulsion systems for locomotives and the like." Sulzer Frères Soc. Anon. August 12th, 1922. (202,206.)
32,478. "Terminals for electrical cells." T. W. Russell. November 20th, 1922. (202,215.)
33,555. "Means for flattening the current waves of pulsating direct current." C. A. A. Haighton. December 10th, 1921. (190,168.)
34,857. "Multiple safety fuse with rotary switch." J. M. Schmieres. December 24th, 1921. (190,728.)

### 1923.

4,606. "Electric lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 17th, 1922. (193,413.)
9,891. "Electric welding." Metropolitan-Vickers Electrical Co., Ltd. April 11th, 1922. (196,285.)
10,763. "Regulation of electric circuits." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). May 2nd, 1922. (Divided application on 199,887.) (202,241.)
11,130. "Flame arc lamp with an enclosed arc." E. Mommsen (legal representative of T. L. Carbone, deceased). April 24th, 1922. (196,631.)
15,221. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 14th, 1921. (Divided application on 179,930.) (199,042.)